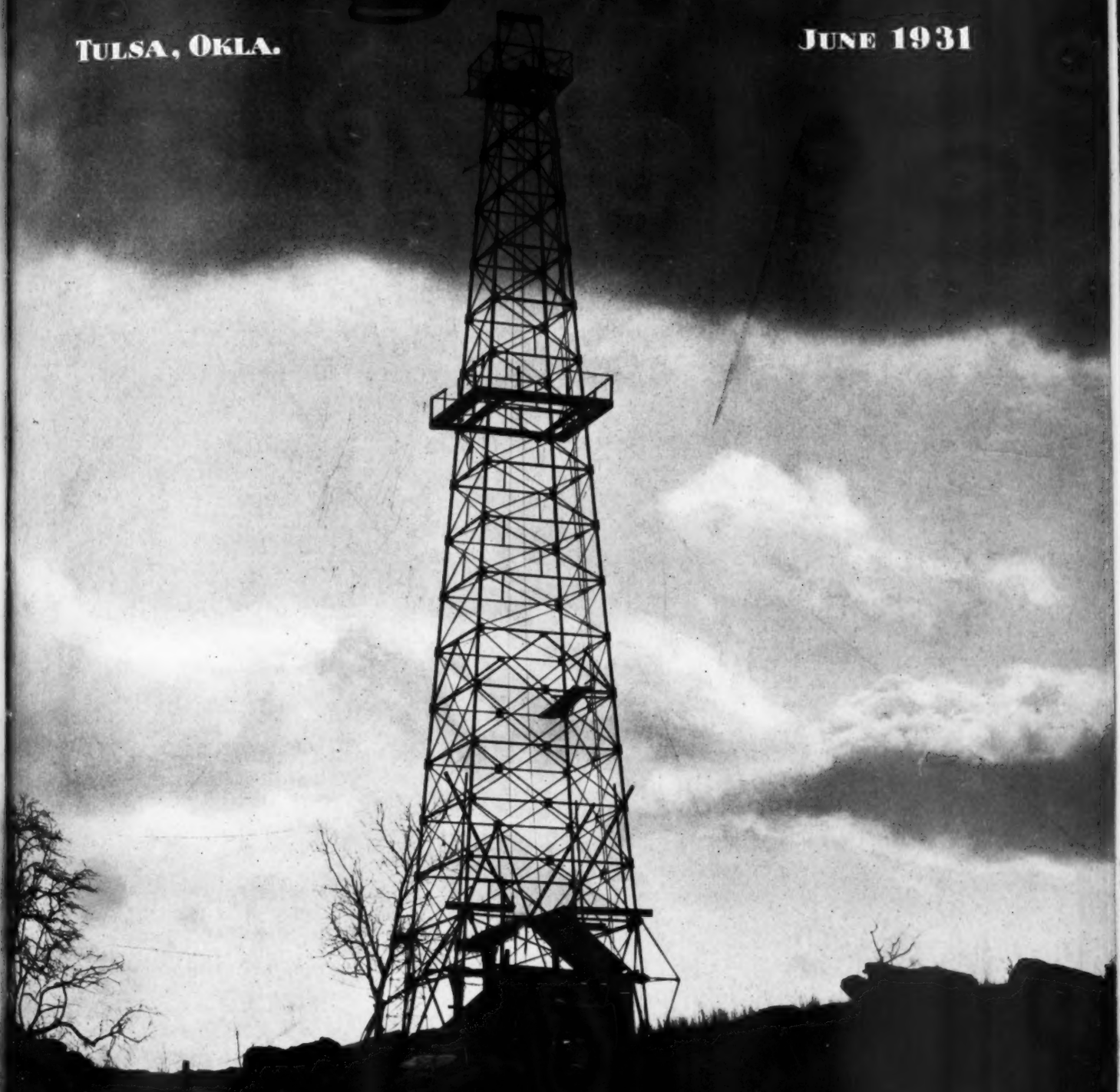
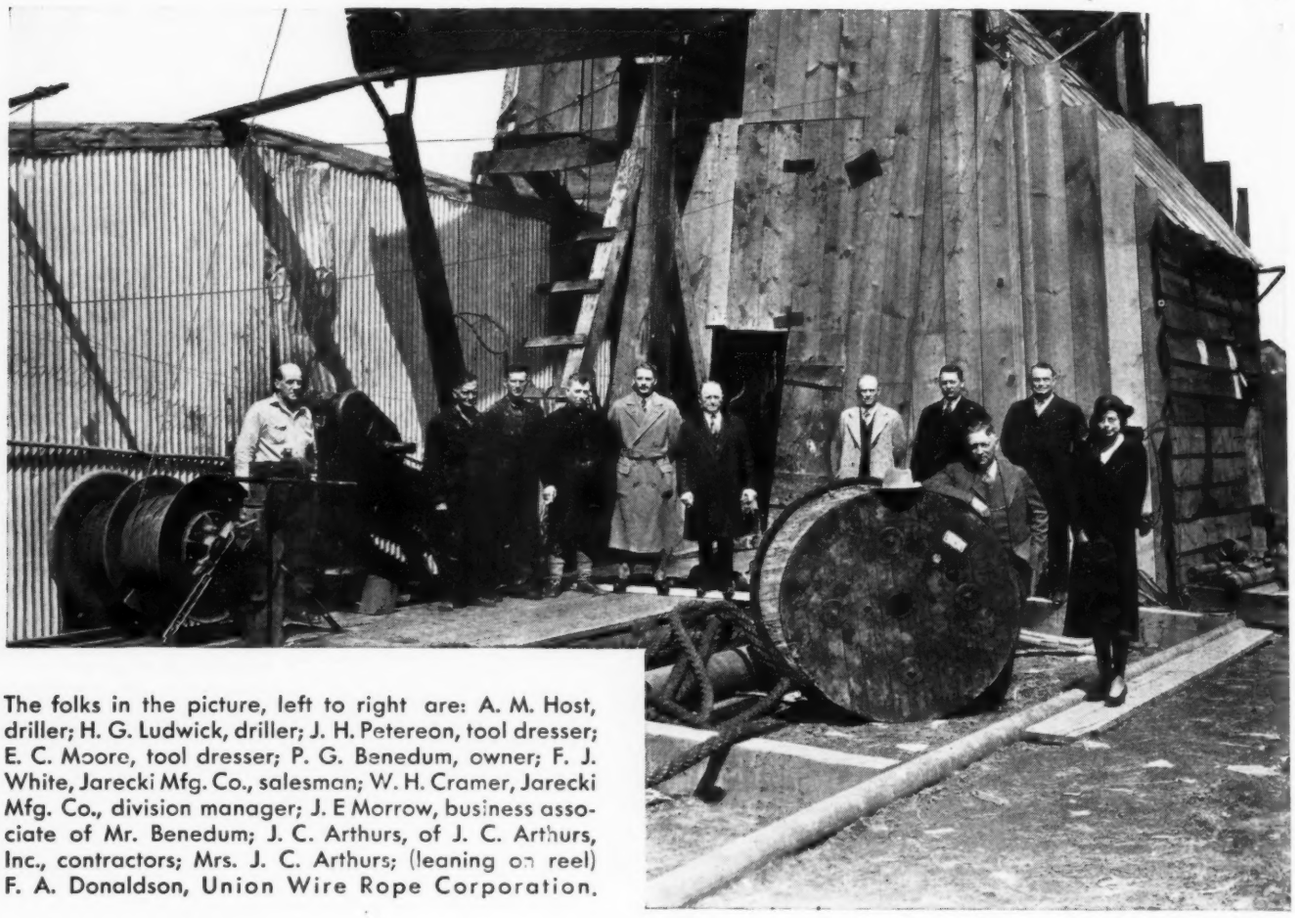
THE Petroleum Engineer

TULSA, OKLA. JUNE 1931



THE ENGINEERING MAGAZINE OF THE OIL AND GAS INDUSTRY

UNION WIRE LINES GIVE SERVICE AT ELMIRA, N. Y.



The folks in the picture, left to right are: A. M. Host, driller; H. G. Ludwick, driller; J. H. Petereon, tool dresser; E. C. Moore, tool dresser; P. G. Benedum, owner; F. J. White, Jarecki Mfg. Co., salesman; W. H. Cramer, Jarecki Mfg. Co., division manager; J. E Morrow, business associate of Mr. Benedum; J. C. Arthurs, of J. C. Arthurs, Inc., contractors; Mrs. J. C. Arthurs; (leaning on reel) F. A. Donaldson, Union Wire Rope Corporation.

Shown above is a well being drilled near Elmira, N. Y., for P. G. Benedum of Pittsburgh, by J. C. Arthurs, of J. C. Arthurs, Inc., Contractors. Since plans were made to go to 5,000 feet in search of gas, wire lines of strictly dependable quality were desired—and UNION wire lines were ordered.

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The Petroleum Engineer

The Engineering Magazine of the Oil and Gas Industry

Edited and Circulated Only for those Actively Engaged in the Operating Departments of the Industry

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THE MONTH'S HIGH LIGHTS IN OILDOM

By J. L. DWYER

MORE proven territory for the East Texas fields, lower crude prices resulting from the rapidly increasing production, and lower quotations for refined products, summed up the month's developments east of California, while from the Pacific Coast territory came a gleam of hope in the thought that the oil industry in California shows a better situation, and as a result crude and refined prices might be expected to advance to higher levels. When the output of crude oil and refined products from East Texas interfered with the normal movement of gasoline and crude oil from the remainder of the Mid-Continent territory, the Stanolind Crude Oil Purchasing Co. announced a sharp reduction, making the average price of Mid-Continent oils lower than they have been at any time during the past twenty years.

There seems to be some hope that a more orderly development programme may soon be in evidence in the East Texas fields, and should this become a reality, better prices for crude oil and its products should be witnessed throughout the Mid-Continent field at least, if not throughout the entire nation.

From a mechanical standpoint, an appreciable increase is noted in the number of wells in the East Texas field which have been prepared for the pump. There is a growing belief in the minds of many who have carefully studied the field that the flowing life of the wells will be rather brief, and the production must be obtained by mechanical methods. This must not be taken as underrating the possibilities of East Texas, for the field now seems to contain at least 110,000 to 120,000 acres of land which will be productive. The estimates of just how much oil to the acre East Texas will produce have also been subjected to a sharp revision upwards during the past few weeks.

The first part of this month at Dallas, Texas, the first semi-annual meeting of the division of production of the American Petroleum Institute was held, and was well attended. An important number of field men, officials, and engineers showed exceptional interest in the papers which were presented, and discussed the various problems at great length.

In the California fields, additional depths are being reached by the drill, and during this month a well between the Ventura avenue and Rincon fields reached a depth of 10,000 feet. This is the first time in the history of the industry that a drilling well has been carried to this depth.

While we have been experiencing a lull in production activities through the oil country, the pipe line departments and natural gas transmission systems have been active. There have been a number of lines laid out of the East Texas region, and it is reported that one or two more will be built from East Texas to the Gulf Coast. Construction of natural gas lines has featured the past two years' line work.

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Production and Refining Figures Furnished by the American Petroleum Institute

Crude Runs to Stills, Gasoline and Gas and Fuel Oil Stocks, Week Ending May 30, 1931

(Figures in Barrels of 42 Gallons)

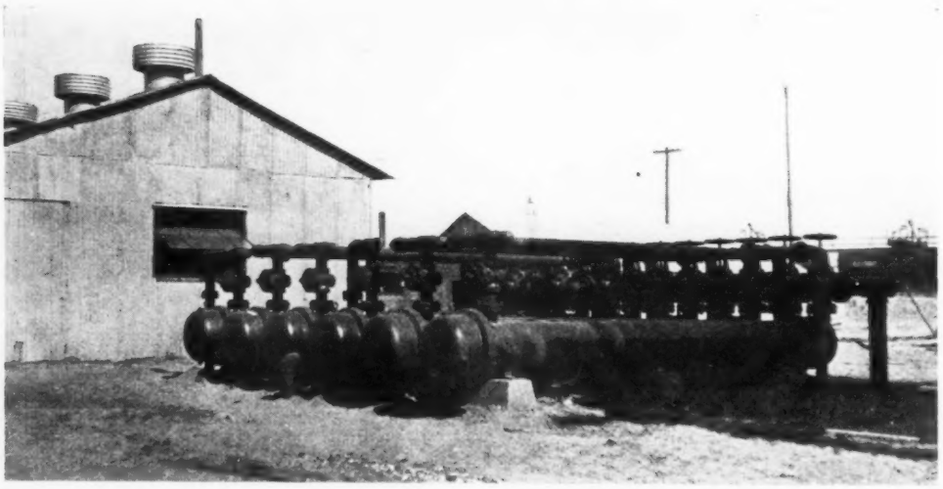
DISTRICT	Per Cent Potential Capacity Reporting	Daily Average Crude Runs to Stills	Per Cent Operated of Total Capacity Reporting	Gasoline Stocks	Gas and Fuel Oil Stocks
East Coast	100.0	496,700	81.1	8,267,000	8,738,000
Appalachian	93.8	96,600	72.9	1,600,000	1,140,000
Ind., Ill., Ky.	97.5	324,700	85.2	6,386,000	3,784,000
Okla., Kans., Mo.	89.4	276,000	67.0	3,645,000	4,264,000
Texas	91.9	575,400	77.4	7,840,000	9,880,000
Louisiana - Arkansas	98.3	176,200	67.3	2,383,000	2,427,000
Rocky Mountain	93.1	48,100	34.4	1,905,000	843,000
California	98.8	480,900	54.2	*12,769,000	98,387,000
Total Wk. May 30	95.7	2,474,600	69.3	44,795,000	129,463,000
Total Wk. May 23	95.7	2,441,700	68.4	45,449,000	128,555,000
Totl. May 31, 1930	95.8	2,566,300	72.8	†52,715,000	†137,593,000
The Texas and Louisiana Gulf Coastal figures shown below are included above in the totals of their respective districts.					
Texas Gulf Coast	100.0	438,400	82.8	6,642,000	6,977,000
La. Gulf Coast	100.0	118,400	80.3	2,226,000	1,491,000

*In California they represent the total inventory of finished gasoline and engine distillate held by reporting companies wherever located within continental United States. †Revised due to change in California.

Daily Average Production

(Figures in Barrels)

	May 30 1931	May 2 1931	May 31 1930
Oklahoma	527,700	545,300	681,050
Kansas	106,800	109,750	135,050
Panhandle Texas	61,800	55,600	112,700
North Texas	56,500	57,250	82,950
West Central Texas	26,400	25,150	58,650
West Texas	210,600	208,600	307,350
East Central Texas	55,600	49,700	38,100
East Texas	350,900	298,400	
Southwest Texas	60,550	63,200	69,000
North Louisiana	38,600	39,150	37,100
Arkansas	46,250	46,800	53,100
Coastal Texas	150,500	162,900	183,400
Coastal Louisiana	29,900	27,850	22,450
Eastern (not including Mich.)	102,800	101,750	126,000
Michigan	8,200	8,550	10,400
Wyoming	42,250	43,300	54,550
Montana	8,650	8,650	9,650
Colorado	4,050	4,050	4,650
New Mexico	45,700	38,550	18,200
California	528,400	528,100	605,100
Total	2,462,150	2,422,600	2,609,450



Heat exchangers in the Taylor Refining Co. plant.

ANTI-KNOCK GASOLINE *from*

THE Taylor Refining Co. recently completed and put into operation a 15,000-barrel refinery at Tyler, Texas. This plant is one of the largest and most modern plants to be built in the East Texas field. The crude is processed by a method which was developed by G. L. Rowsey, president of the company. One of the products produced at the plant is a U. S. motor gasoline of high anti-knock rating, the octane number ranging from 65 to 70.

Crude oil is delivered to the plant from the Joiner, Bateman and Lathrop fields by the Tyler Pipe Line Co.

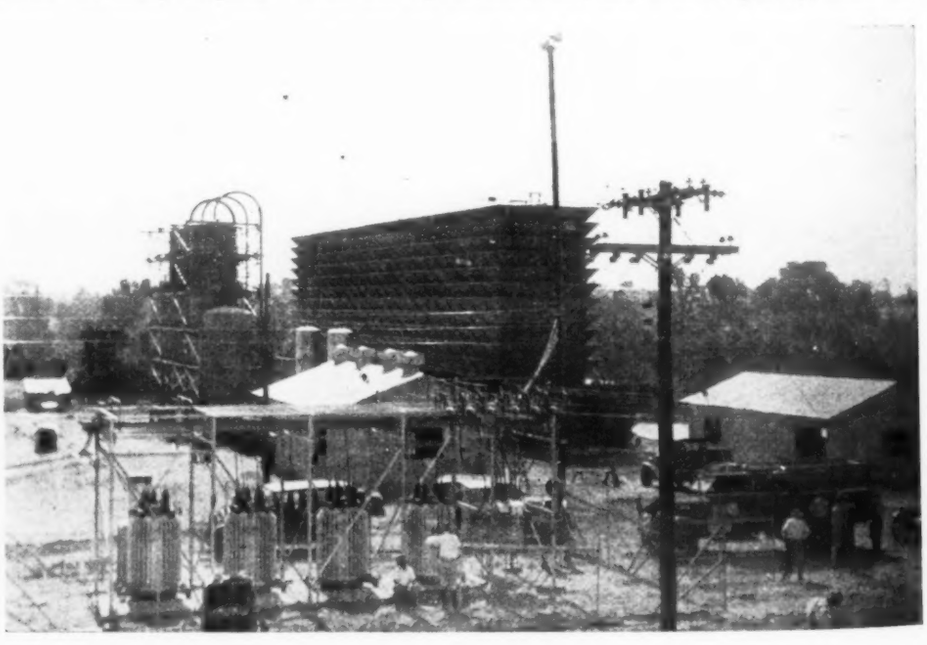
This is the second refinery to be built by the company. The first one is located at Taylor, Texas, from which the company gets its name. It is a 5,000-barrel plant and uses the same type process to refine the oil.

The Tyler refinery required about three months to build. It employs about 40 men, including the office and laboratory personnel. The plant is very compact, and the simplicity of design minimizes operating costs and investment. Modern equipment is installed in the plant. In many respects the layout suggests that of a natural gasoline plant.

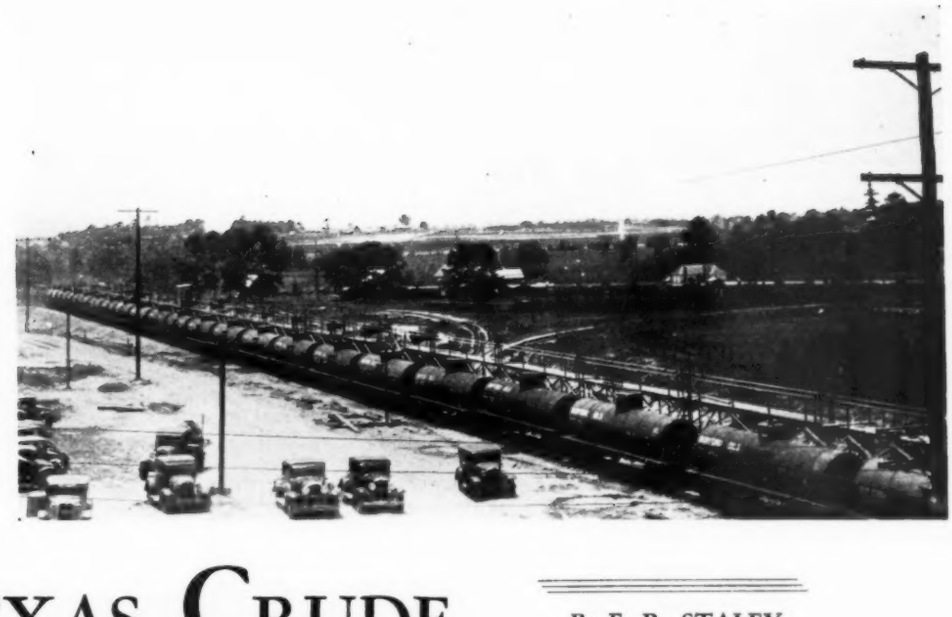
Pumping equipment in the plant is electrically driven. Motor-driven centrifugal pumps are used for water, gasoline, crude, hot oil, etc. The plant is lighted at night by electric flood lights. An unusual feature of the layout is the entire absence of steam boilers. Steam for distillation is generated in the bubble tower from a water spray. The Rowsey process used at the plant employs three pipe stills, the third of which operates under pressure. Two of the stills are used for skimming the crude. Each of these has a capacity of 7,500 barrels per day. The high-pressure still has a charging capacity of 10,000 barrels per day.

The crude oil is fed to the first two pipe stills through heat exchangers. The light vapors are first flashed off in an 8 by 20-foot bubble tower. The oil is heated in the first flash to 500 degrees F. and fractionated in the first of three 8 by 35-foot bubble towers. From the top of the first tower a cut of 64-66 gravity 375 degrees F. end point gasoline is made. The oil is heated to 600 degrees F. in the second flash and fractionated in the second bubble tower from which a 400 degrees F. end point gasoline is taken, and a 41 gravity kerosene cut is cut from the side of the second tower.

The residuum from the second tower is then picked up with a high-pressure hot oil pump and charged to the pressure still. The oil is heated to 860 degrees F. and flashed into the third bubble tower. A U. S. Motor gasoline of high anti-knock rating (65 to 70 octane number) is taken from the top of the tower, and a 32-34 gravity, straw col-



Transformer bank for electrical pumping system at Taylor Refinery.



Loading rack, East Texas Refining Co., Longview, Texas.

EAST TEXAS CRUDE

By F. R. STALEY

ored gas oil is taken from the side of the tower. The fuel oil is pumped out through very efficient heat exchangers against the crude charge.

The vapors from the towers are condensed in Bentube sections located in the cooling tower. This has a capacity of 4,000 gallons per minute. The warm water flows into a large pond located beside the tower. It is picked up by the centrifugal water pumps and circulated over the tower. City water is used in the plant at the present time, but a number of water wells will be drilled in the near future.

There is no receiving house in the plant for the oil streams from the condensers. Receiving tanks are located beside the cooling tower.

Automatic control instruments are used on all of the fractionating towers. These also record the temperatures of the vapor lines.

The straight-run gasoline produced at the plant is sweet, non-corrosive, and very stable to sunlight. It is almost entirely gum free, and requires no chemical treatment. The knock rating is from 55 to 65 octane number, depending upon the end point.

Approximate Yields

Gasoline	45 per cent	Fuel Oil	20 per cent
Kerosene	6 per cent	Loss	3 per cent
Gas Oil	26 per cent		

The pressure gasoline produced is given a sodium plumbite wash to sweeten it. This is done in a closed continuous treater. The kerosene is water white and sweet.

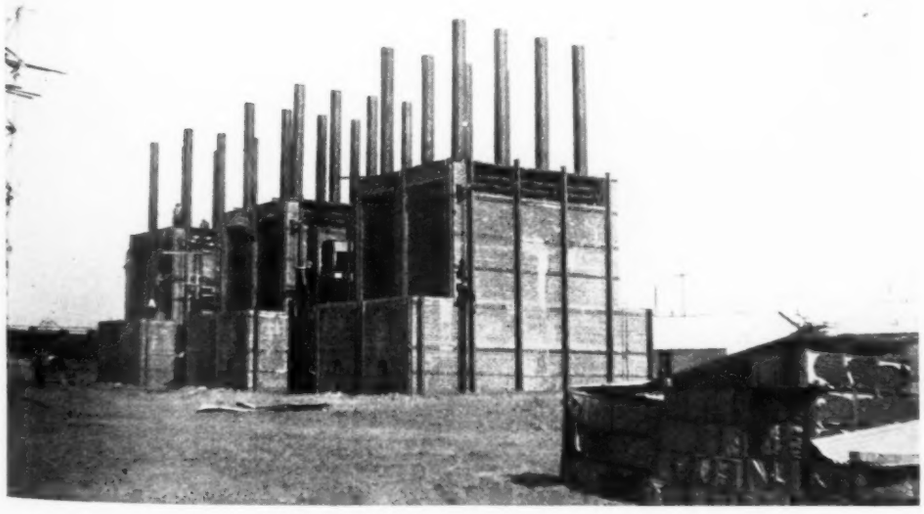
The gas oil is straw color, and meets U.G.I. specifications.

Most of the products from the plant are shipped out in tank cars. A loading rack having a capacity of 60 cars is located at the refinery. The refinery has 12 storage tanks, having a total capacity of 230,000 barrels. These tanks are all welded and aluminum painted.

There are three pump houses in the plant. One is used for the water pumps, one for transfer and loading pumps, and one for those to the distillation units. Buildings are of sheet metal and steel construction.

Another building houses the offices and the testing laboratory. The latter is completely equipped with modern testing apparatus.

Mac Kennedy is district manager for the company. J. L. Bryan is superintendent of the refinery, and B. H. Perginson is chief engineer.



Taylor refinery pipe stills.

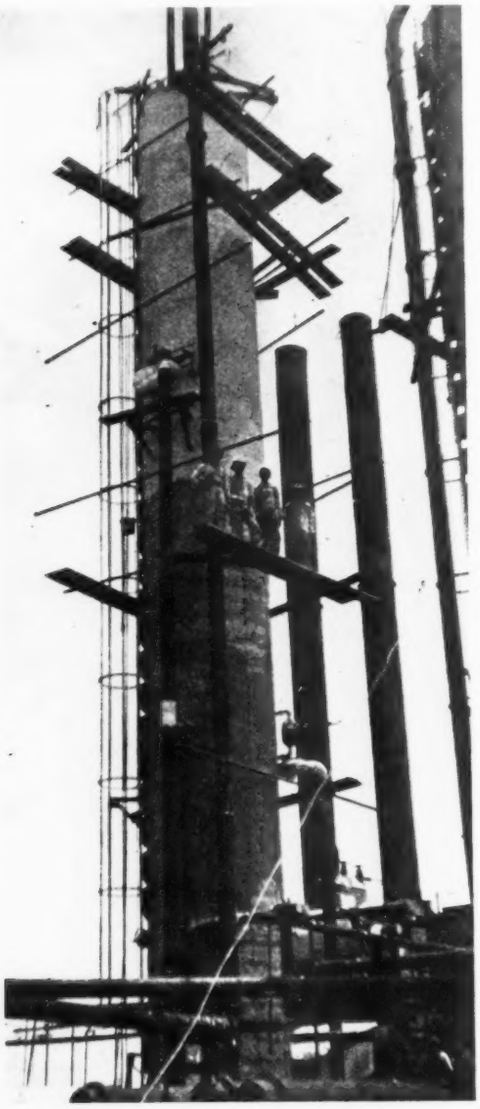
Longview Refinery

During the month the East Texas Refining Co. completed a new 5,000-barrel distillation unit in its refinery at Longview. This gives the plant a total capacity of 10,000 barrels per day. This company operates a 5,000-barrel refinery at Henderson also.

The distillation units at Longview each consist of a pipe still, and a 7 by 68-foot

bubble tower. The condensers are located in the cooling tower.

The crude is fractionated into four streams in each tower. A 410 degrees F. end point gasoline of 62 degrees A. P. I. gravity is taken off the top of the tower. A 42 degrees A.P.I. gravity kerosene and a 32-34 degrees A. P. I. straw gas oil are taken off the side. The gas oil meets U. G. I. specifications. A 22 degrees A. P. I. gravity fuel oil is taken from the bottom of the tower. All of the fuel oil is sold to the railroad. Steam for the plant is generated by two 310-horsepower water-tubular boilers.



Insulating a unit in an East Texas refinery.

Steam is used in the fractionating tower, and for the pumps. Water for the plant is produced from wells. The construction of this plant was described in a former article by the author.[1]

Approximate Yields

Gasoline (U. S. Motor)	40 per cent
Kerosene	14 per cent
Gas Oil	11 per cent
Fuel Oil	33 per cent
Loss	2 per cent

J. J. Thomas is vice-president and general manager of the company. E. L. Rogers is superintendent of the Longview refinery.

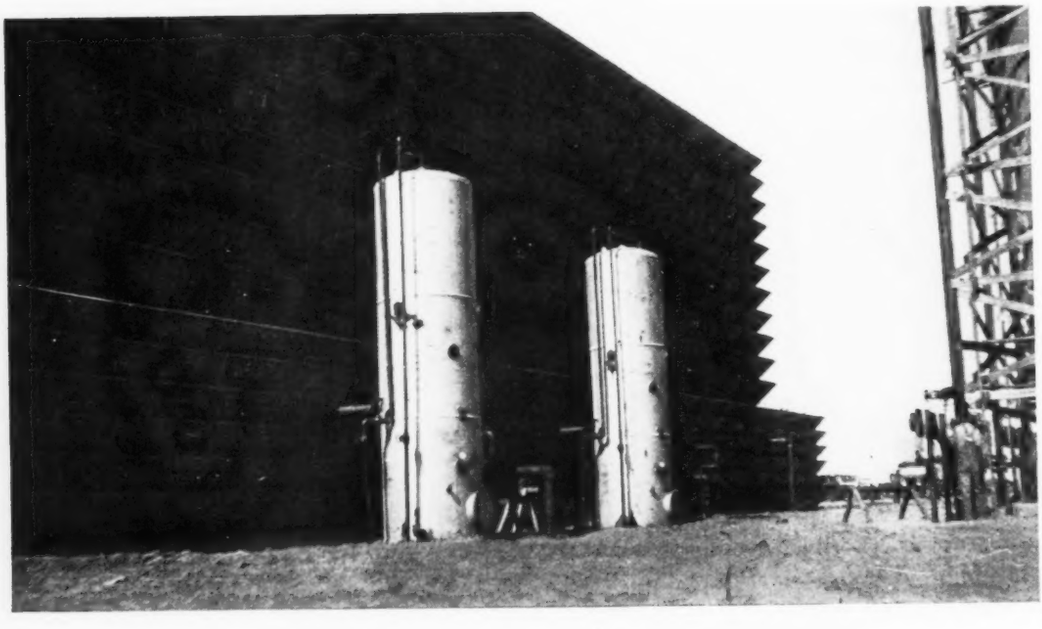
In addition to the two plants just described there are several topping plants having capacities under 5,000 barrels per day located near various towns in the East Texas field. Some of these plants have very poor and inefficient equipment, and were built merely to take advantage of the low price for crude oil. Due to the large percentage of straight-run gasoline obtained from the crude, which is sweet and practically sulphur free, the operation of the skimming plant is very simple. The gasoline is trucked to many nearby towns and cities.

Since East Texas crude oil is so plentiful and desirable from a refining standpoint, it is being transported to many refineries located on the Gulf Coast and outside of the state. Consequently, it is being refined in many ways. The crude contains a mixed base, and yields considerable paraffine and lubricating fractions. It can be processed to yield a wax distillate or an overhead bright stock by the various methods used for high-grade Mid-Continent oils.

Some refiners are topping the crude, taking off a gasoline, and a kerosene cut, and then cracking the reduced crude. In so doing the wax is cracked, and when fuel oil is produced the pour point is considerably reduced. Due to the wax content the topped crude has a very high pour point, usually from 90 to 100 degrees F.

Another method is to run the reduced crude to coke in a shell type still, and crack the heavy overhead distillate after removing the light fractions.

During the next few months there will no doubt be a number of new plants constructed in East Texas, and many more refineries outside the field which are so located that they can be supplied with this crude will find it advantageous to obtain it. During the month the Atlantic Producing Co. purchased extensive properties in the area, and in the near future the refineries of the Atlantic Refining Co. in Pennsylvania will run this crude. The crude is also being exported to other countries.



Receiving tanks and cooling tower, East Texas Refining Company.

[1]Pet. Engineer, Apr., 1931.

Christmas tree hook-up on a well in the East Texas field.

SOME OBSERVATIONS *on* Production Practice *in* East Texas

By K. C. SCLATER

These four 6-inch lines were required to carry off the gas from a battery of lease tanks.

ON June 1, 1931, there were 735 producing wells in the recently-discovered East Texas field. Only 22 of these wells on this date were being produced by pumping; all the others were producing by natural flow and almost all were still in the flush stage of production. The 22 wells already on the pump are in the Joiner area, the part of the field first to undergo intensive development, as it was there the discovery well was brought in last September.

Analyses of the gas show that it is high in wet gas constituents. One gas analysis report showed a butane content of about 40 per cent. The results of three tests on vent line gas from three different wells are given below:

Oil production, bbls.	2,750	2,400	12,300
Gas production, M. c. f.	750	1,000	3,500
Gravity of oil, °A. P. I.	38.5	1.65	39.5
Specific gravity of gas	.....	1.25	1.23
Gallons, /M. c. f. gross	11	10.3	8.1
Gallons, /M. c. f. @ 60° F.	6.2	5.5	4.1

Wells are brought in with an average initial production of 20,000 barrels a day when gauged under open-flow conditions. The gravity of the oil is approximately 40 degrees A. P. I. for the field. Production in this field is characterized by low gas-oil ratios. Analyses of the gas and

oil and estimates of original rock pressure indicate that all gas is dissolved in the oil and that no free gas exists in the reservoir.

In the accompanying table A. F. Melcher gives some interesting data on initial production, per cent porosity, thickness and description of the producing sand in East Texas field.

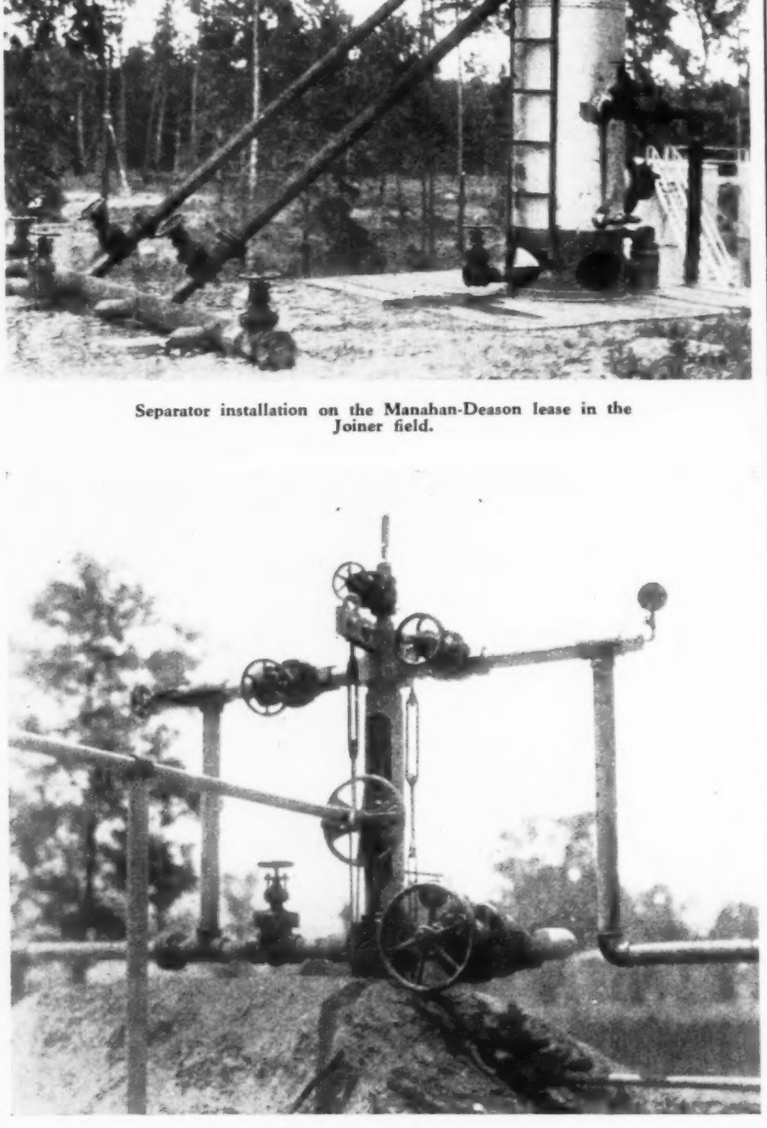
The original rock pressure is estimated by one major company operating in the Kilgore area as having been 1,550 pounds per square inch. Actual bottom-hole pressure readings of 1,520 pounds per square inch were obtained by this company. On one well that had stopped flowing a bottom-hole pressure reading of about 1,175 pounds per square inch was obtained. It would seem from this that the flowing life of wells in this field will be relatively short and that a large part of the production will be obtained by pumping unless immediate steps are taken to conserve or maintain the rock pressure.

From these data the conclusion can be drawn that the ratio of wet to dry constituents in the gas is probably such as to account for wells ceasing to flow while the bottom-hole pressure is still relatively high.

It is standard practice to flow wells through 2½-inch tubing. Capacities of wells for proration purposes are determined by flowing wells through 2½-inch tubing with an 1⅛-inch (or ¾-inch) surface choke nipple.

Christmas tree hook-ups vary. Some consist of two flow lines from the casing and two flow lines from the tubing to the well separator. Flow lines are usually 3-inch or 4-inch diameter and are connected into the trap as shown on accompanying illustrations. Other casinghead connections are found in the field, consisting of only a single or a double flow line to the trap.

Separator installation on the Manahan-Deason lease in the Joiner field.



Christmas tree hook-up on a Joiner pool well.

Both removable and adjustable type flow beans are used. One removable type surface choke nipple is in use in the field that permits swabbing the tubing, or taking an open-flow test simply by removing the throat, and does not necessitate disturbing any casinghead connections. The average well head hook-up is so arranged that the well can be flowed either through the casing or through the tubing.

All wells are equipped with separators, the size depending on the size and character of the well. One feature of gas and oil separation is observed that is peculiar to the field. It is the relatively slow, compared with other fields, separation of the gas and oil. This is thought to be due to the character of the oil and gas and also the relatively high content of wet constituents in the gas. Gas and oil separators are equipped with float liquid level controls. One trap in wide use has a diaphragm liquid level control in addition to the float liquid level control.

It has become general practice in the field to take the precaution to burn all waste gas instead of blowing it into the air. So heavy is the gas that if it is released to the atmosphere on a still day it will not rise, but will fall and cling to the ground and fill any depressions or low-lying areas in the vicinity. When it does this it sets up a grave fire hazard. Several serious accidents have already occurred through this gas having become ignited. This hazard is minimized by having all lease tanks made vapor-tight and the top of each tank in a battery connected into a gas manifold so that the vapors can be carried off about 400 feet, at least, through 4- or 6-inch lines to one or more standpipes, where the gas is burned in a flare.

Gas fuel lines are equipped with valves which release the

excess gas into lines that carry it off to a standpipe at a safe distance to be burned.

On a lease in the Kilgore area a battery consisting of four lease stock tanks was equipped with four 6-inch lines which were required to carry off the heavy vapors when oil was being run into the tanks at the rate of about 20,000 barrels daily.

Casing and tubing pressures vary from 50 pounds or less to 400 pounds or more, depending on how the well is produced and in which area the well is situated.

Salt water is known to be present in the west edge of the field. The presence of water has been detected in wells drilled too deep. A bottom-hole temperature of 163 degrees F. was obtained in a well making some salt water. This is higher than the average bottom-hole temperature of the oil, which in the Kilgore area is 148 to 155 degrees F. When the well is choked the temperature of the oil at the surface is approximately 80 degrees F., and when the well is flowing open the temperature is 135 degrees F. Temperatures are being taken on some wells in the field and these should give a hint of water encroachment if present or imminent.

Two companies in the field have installed gas-lift plants, but have been enjoined from putting them into use.

If there is danger of serious water encroachment in the field, as seems to be the case, and the gas is low in volume and relatively low in methane content, the judicious use of the gas-lift would be an effective means of holding back water and conserving the gas in the sand and consequently reservoir pressure. Provision might be made for obtaining equitable potentials so as to prevent excessive rates of oil production from the pool at the expense of operators not using the gas-lift.

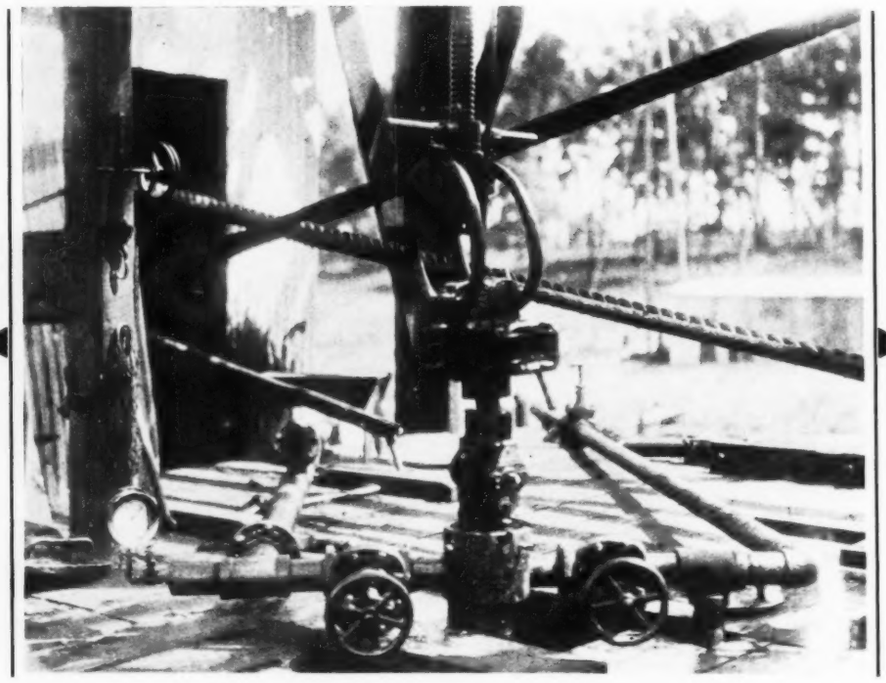
On the whole, the East Texas field shows somewhat diverse trends in production practice, and this condition can probably be accounted for by the rapid pace at which the field has been developed and to the economic conditions existing within the industry.

Casinghead connections on the Humble Oil & Refining Company's No. 1 Crim, in the Kilgore area.

Christmas tree and separator connections on a well in the East Texas field.

One of the unique features of the field is the dearth of gasoline plants, despite the fact that the gas, although not in excessive volume when considered in terms of the average quantity produced per barrel of oil, is extremely rich in gasoline content. Competitive drilling conditions, acreage held in small blocks, and a depressed gasoline market have been responsible for discouraging the building of natural gasoline plants at this time. Also, competitive drilling conditions and acreage held in small blocks among a large number of diversified interests have been responsible for some of the more progressive operators not taking the rich gas that is now being burned and returning it to the reservoir to serve the double purpose of increasing the ultimate oil recovery and retarding water encroachment by maintaining the reservoir pressure.

If the observation that a well ceased to flow when a bottom-hole pressure of 1,175 pounds per square inch can be taken as an indication of the critical bottom-hole pressure below which the average well in the field cannot be made to flow, even with small-size tubing in the well or by any natural means, lifting costs must inevitably greatly increase almost overnight. There seems little chance of applying any remedy under the present development conditions that exist in the field.



Casinghead connections on the Manahan Oil Company's No. 1 Deason. A swab was in the well when this picture was taken.

EAST TEXAS FIELD
TABLE GIVING INITIAL PRODUCTION, PER CENT POROSITY, THICKNESS OF SAND AND DESCRIPTION OF SAND

(By A. F. MELCHER, Tulsa, Okla.)

Location	Depth Ft.	Initial Production Bbls.	Per Cent Porosity By Volume	Thickness of Sand Ft.	Description or Remarks
Well on Mayfield-Alford lease, Joiner area, offsetting the discovery well.		About 4,000	16 to 28	15	Small sized grains, smooth surface.
Well on Irion lease, Pru survey, Joiner area, three miles west of discovery well.		15,000	12 to 30	40	Large grained sand, smooth surface.
Foster well, Joiner area.	3613 3620 3628	10,000	27.5 10 22	18 to 20	Small sized grains, smooth surface. Fairly fine grained, cemented. Small and large grained sand, smooth.
Well ¼ mile south of discovery well, Kilgore area.	3594	25,000	34	40	Large grained with some fine grains, smooth surface.
Well on east side of Joiner area.	3611	3,500	24	10	Fine grained sand with some large grains
Sample of sand from Van pool.			33		Fairly large and smooth grains.
Ashby well, Joiner area.	3518-3525	3,000	28	7	Fine grained, smooth surface.
Well in Van pool, M. Gross survey.	2504-2595 2640-2680	2400 thru 11/16" choke	28	131 or more	Fairly large and smooth grained.

Some of the factors which largely control the rate and ultimate production of oil in the East Texas field as indicated by the above data are saturation, size of grain, smoothness of surface of grains, porosity and especially thickness of pay, as well as the large extent of area of the field. While the gas pressure falls rapidly in some areas of this field, this unfavorable factor is largely compensated for by a large porosity, fairly large and smooth grained sand, and high gravity oil. The ultimate production of oil per acre will vary greatly as the above factors vary. In areas of high saturation with oil, high porosity, and large grained sand with smooth surfaces, the ultimate production per acre foot may go as high as 1,200 barrels or more. In other areas of less saturation with oil, low porosity, small sized grains with irregular surfaces the ultimate production per acre foot of the pay sand may go as low as 300 or 400 barrels or lower.

The data given above also indicate that the sand is not a shore line deposit, as the larger grained sand occurs farther out from the uplift.

Continental Made Good Time in Building Oklahoma City Line

By J. H. DAMERON

Ditching for the Conoco line.

CONTINENTAL Pipe Line Co., the transporting subsidiary of the Continental Oil Co., established an enviable record of construction on its recently-completed 8-inch crude oil line originating in the Oklahoma City field and terminating at the company's pipe line station 14 miles from Ponca City, Okla.

This line was constructed to deliver crude produced by the Continental Oil Co. in Oklahoma City to the Ponca City refinery. The Oklahoma City field gathering system delivers the crude to the field station storage, consisting of two 10,500-barrel tanks.

The station is a 40 by 100-foot steel frame and corrugated iron building housing a 265-horsepower and a 200-horsepower full Diesel engine, driving duplex line pumps. One of the pumps has a capacity of 15,000 barrels daily and the other a capacity of 10,500 barrels daily, or a combined capacity of 25,500 barrels daily. This station delivers the crude to Ogg station, 80 miles distant, which is located 14 miles from the Ponca City refinery tank farm.

The entire project was supervised by the engineering department of the Continental Oil Co., and the contract for construction awarded to the Truman-Smith Construction Co.

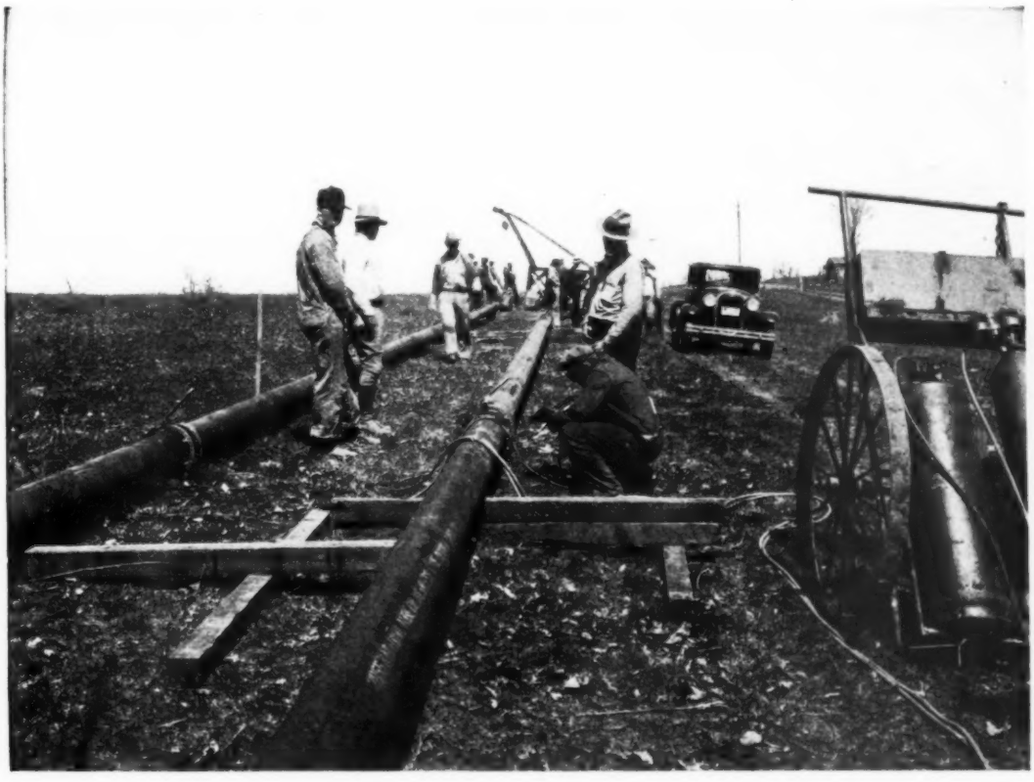
The greater portion of the line goes through broken and rough country and through hills of rock, where blasting was necessary. There were two river crossings made—the North Canadian and the Cimarron rivers—and four stream crossings going into the classification of major jobs.

A greater number of trucks than ordinarily used was necessary for the stringing of pipe, as the highway commission load limit allowed only an average of seven joints per truck.

Heavy wall 8⅝-inch National Tube Co. seamless pipe was used to construct the artery. It had a wall thickness of .322 inch and weighed 28.5 pounds per foot. The pipe was shipped in random 40-foot lengths and was plain end line pipe beveled for welding.

A special truck equipped with a gin pole was used to unload the pipe at the various shipping points, either unloading from the cars to the ground or direct to the trucks.

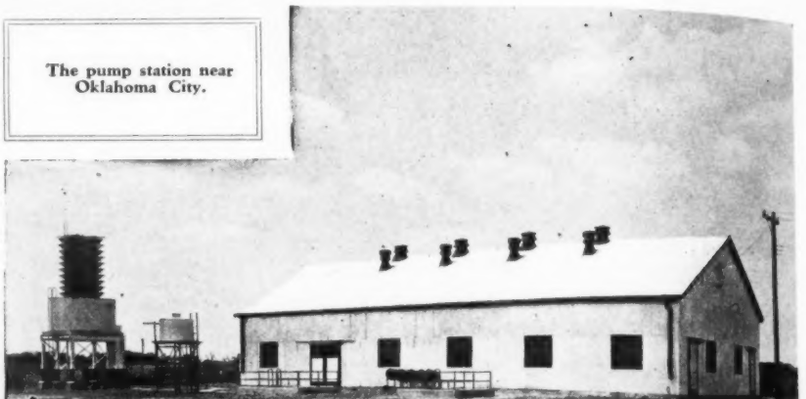
Four ditching machines were used to cut a trench 18 by 32 inches, while four gasoline-driven shovels cut the ditch for approaches to rivers, creeks and highway crossings. These shovels were also used where necessary to skim a



Welding the pipe.

path for the ditchers through underbrush and to clear such obstacles as might slow up ditching.

The lineup and tacking crew worked just ahead of the firing line and moved forward at about the same rate of speed. The lengths were lined up on skids and tack-welded. The firing line welders made the roll welds as their helpers turned the five-length sections with tongs. The bell hole welders worked considerable distance behind the firing lines. All of the bends were made cold and no trouble was experienced with buckling lengths or split joints. Occasionally welds were cut out for testing purposes.



The pump station near Oklahoma City.

Continental company inspectors consisted of two lay inspectors, four welding inspectors, two ditch inspectors and two material checkers. This crew was divided into two sections, one section inspecting work started at the south end of the line and the other inspecting the north section. Only those sections of the line through marshes and across rivers and streams were coated with a cold application of paint.

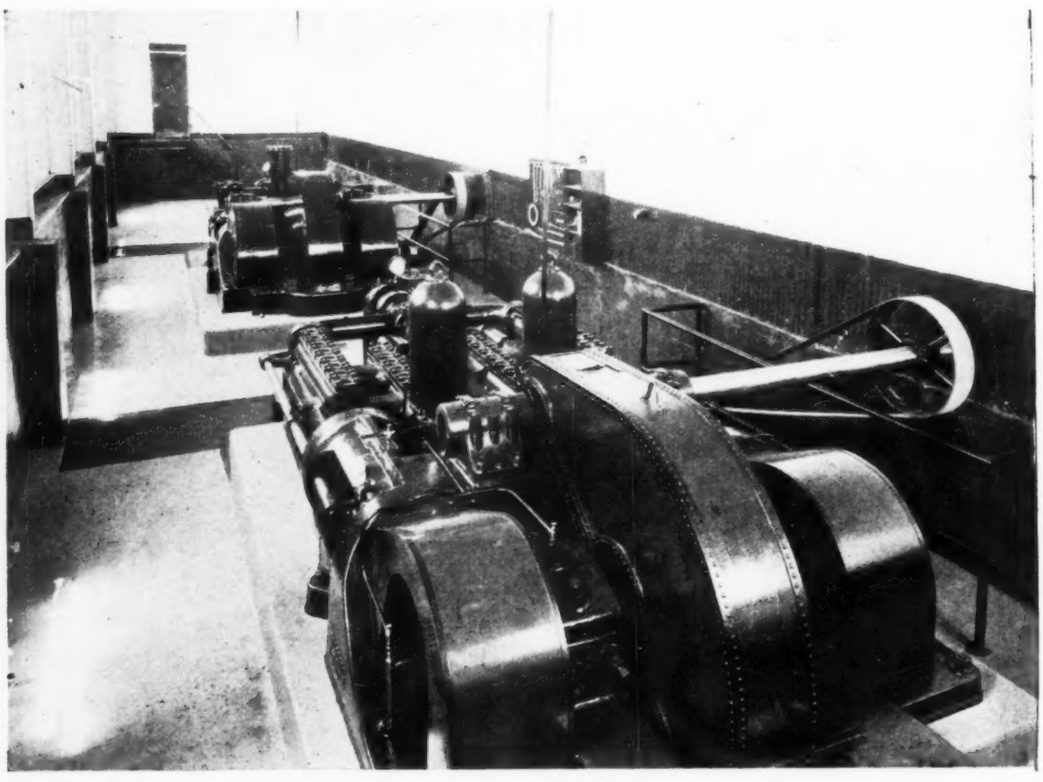
Approximately one-half of the length of the line was acetylene welded with a standard rod making a ripple weld. The balance of the line was welded with a new and faster burning rod. This latter process reduced the welding crew in half and made as much speed again as the former method.

Test of the welds made with the fast-burning rod showed a slight gain in tensile strength, together with a potential saving to both company and contractor, over the standard ripple weld. Record construction time of this project is due to the welding process, efficient program of the contractors, together with the flexibility of modern pipe and equipment.

The contract was awarded December 14, 1930, and construction started December 18, 1930. Lost time due to delayed rail service totaled five days and rain delayed work one and a half days. The project was completed on January 16, 1931, a total of 23½ working days.

The right-of-way for the line was purchased several months in advance of actual construction and no delays were occasioned by right-of-way difficulties.

It is believed that the laying of the 80 miles of the 8-inch welded line in 23½ working days constitutes a new pipe line laying record. It is interesting to note that when this line was tested to 1,200 pounds pressure there was but one pinhole leak in a flange at one of the valves where the crew failed to pull a bolt to its full tightness.



The pump room side of the Oklahoma City station.

Gauging Gas Wells by the
BACK PRESSURE METHOD

By MAX K. WATSON,
Gas Engineer, Canadian River Gas Company, Amarillo, Texas

THE back pressure method of determining the open flow and capacities of gas wells under various back pressures and well conditions is a method parallel to the technical determination of factors influencing the operation of any power generating unit. Blowing a gas well into the air to determine the quantity of gas it will produce under conditions which never occur in actual operation is as unsound as blowing steam into the air to check the horse power of a boiler or draining a water reservoir to determine the amount of water that was in it. It is true, that nothing can be done to change nature's design of a gas field, but a study can be made that will determine the best method of utilizing this natural resource.

The back pressure method of testing gas wells is based on a sound theory of gas flow through a producing formation from the main reservoir to the well bore, similar in some respects to pipe line flow. Experiments and tests have shown that the succession of back pressure points and corresponding deliveries bear a straight line relation to each other when plotted on logarithmic co-ordinate paper. That is: the equation $Q = C\ (P_f^2 - P_s^2)^n$ holds true for any condition of pressure and delivery on any particular well in which the conditions in the well or producing formation has not changed during the test. In the above equation: "Q" is the delivery at the absolute back pressure on the producing formation, "P_s"; "P_f" is the absolute rock pressure at the producing formation; "C" is a constant, determining the location of the straight line curve on the co-ordinates; and "n" is a constant exponent determined by the slope of the curve or change in rate of delivery in respect to the back pressure. The rate of delivery, "Q", is plotted as one ordinate on logarithmic co-ordinate paper with the difference in the squares of the formation pressures, $(P_f^2 - P_s^2)$ as the other ordinate. The absolute open flow is that point on the curve where there is no back pressure or "P_s^2" is zero and "$P_f^2 - P_s^2$" equals "P_f^2". Plate No. 3 is a typical back pressure curve. The rock pressure on this well decreased from 312 pounds to 291 pounds between tests effecting only the absolute open flow of the well as shown, which would be expected. Assuming that the well and producing formation conditions will not change, the open flow to be expected from this well when the rock pressure has declined to 50 pounds is 4,700 M. cubic feet as shown on the curve.

The back pressure curves are also valuable in studying the changes in the conditions of a gas well as indicated on Plates No. 1 and No. 2. The curves on Plate No. 1 were obtained from one well from three tests at approximately three months' intervals. Test No. 1 was the initial test. Test No. 2 was made three months later and indicated that some change had taken place in the well between tests. The well was blown as soon as possible, because it is located in an area in which the formation overlying the gas production tends to cave, and considerable cavings were blown out. The well was again tested a few weeks later and the third back pressure curve obtained. The curves on Plate No. 2 were similarly obtained on another well in the same area. The curves from the back pressure tests shown on Plate No. 1 indicate that some cavings were in the well when the initial test was made while the tests shown on Plate No. 2 indicate that the initial test was made through a clean well bore. This condition is indicated by the change in the characteristics of the curves on each subsequent test. These curves show the value of the tests in indicating the accumulation of cavings in the well and will likewise indicate other changes of importance in

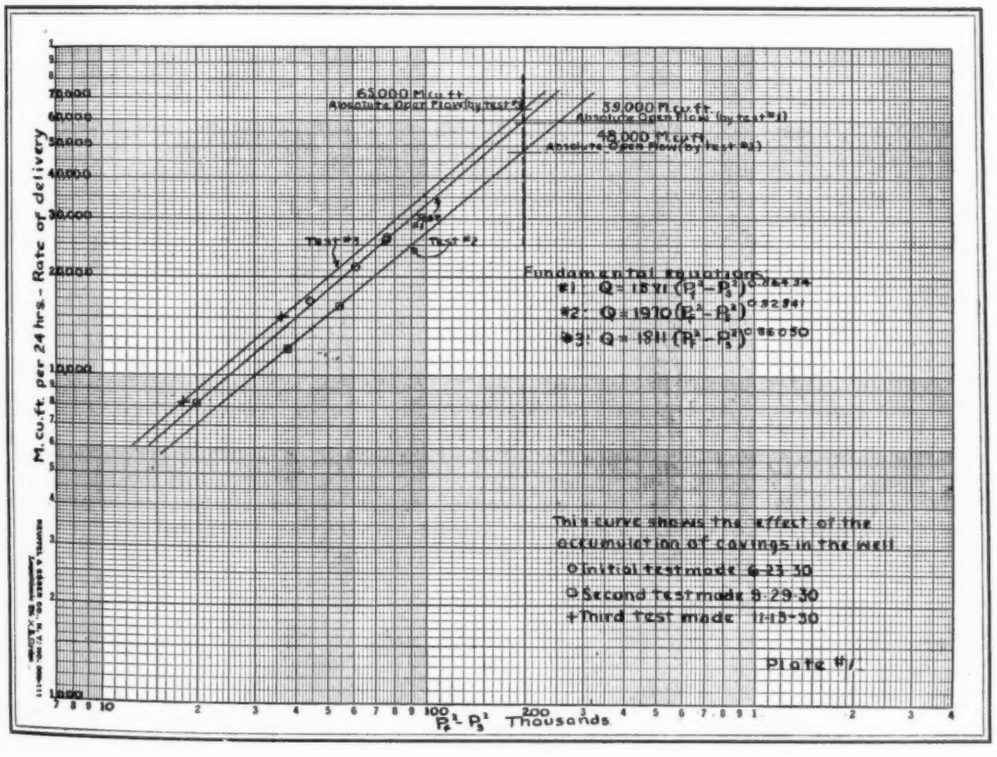

63,000 M cu ft
Absolute Open Flow (by test #2)
59,000 M cu ft
Absolute Open Flow (by test #1)
48,000 M cu ft
Absolute Open Flow (by test #3)
Test #1
Test #2
Test #3
Fundamental Equations
#1 Q = 1871 (P_f^2 - P_s^2)^0.744 35
#2 Q = 1910 (P_f^2 - P_s^2)^0.82 941
#3 Q = 1911 (P_f^2 - P_s^2)^0.85 050
This curve shows the effect of the accumulation of cavings in the well
Initial test made 6-23-30
Second test made 9-29-30
Third test made 12-15-30
Plate #1
M. cu.ft. per 24 hrs. - Rate of delivery
P_f^2 - P_s^2 Thousands

Plate No. 1.

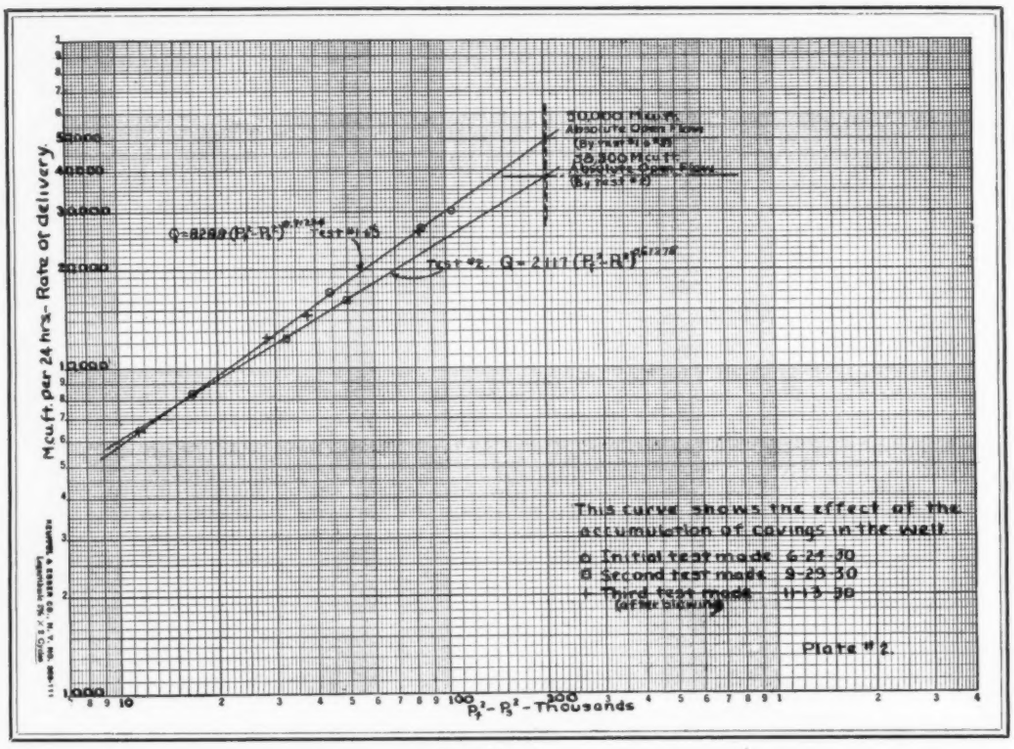

M cu ft per 24 hrs - Rate of delivery
$P_c^2 - P_s^2$ - Thousands
This curve shows the effect of the accumulation of casings in the well
Plate # 2.

Plate No. 2.

the operation of a gas well. The back pressure method of gauging the open flow of gas wells is generally compared to the quantity represented by a Pitot tube test. Fundamentally, the two methods should check, but the inherent errors in the practical application of the two methods will generally result in comparatively small differences if gauged on the same basis. In practical application, there is more opportunity for incorrect gauging by the Pitot tube method than by the back pressure method. The impact pressure due to the velocity of discharge of the gas from a pipe is the basis of measurement used with the Pitot tube and errors due to turbulent flow, water, mist, or dust in the gas stream and the position of the Pitot tube tip in the pipe all cause large errors in the quantity indicated by the impact pressure. All Pitot tube tables have been determined from tests or a theory based on ideal conditions which seldom occur in actual gauging. The back pressure method of gauging is more nearly accurate in that the measurement is as exact as is orifice meter measurement and several different readings are taken, under different conditions, which must check to obtain a straight line relation. There are many points in a back pressure test where inaccuracy will result in an incorrect test, but these errors usually result in a deviation from the straight line relation indicating a questionable result.

The back pressure method of gauging gas wells can be considered as an advancement in gas production. The saving of gas alone is of incalculable value disregarding the advantage gained in having an actual working picture of a well under operating conditions and a real indication of the approach of trouble. A great deal has been accomplished in the last few years by the Bureau of Mines and others in gathering data and applying this method to many gas fields throughout the country and the method has proved applicable in practically every instance.

It is not surprising that new methods are slow in developing when it is considered that the production of gas on a large scale is in the early stages of development, but the investment of large amounts of money in gas properties will necessitate the development of more conservative methods in handling this natural resource. The back pressure method of gauging should be considered as one step in that direction.

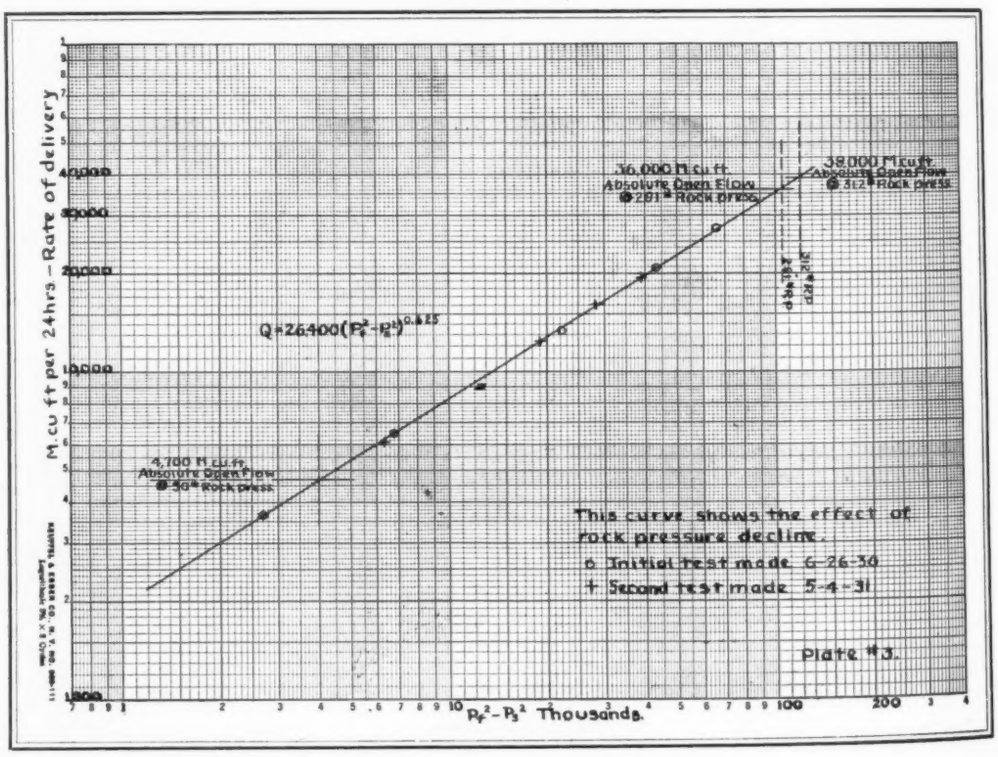


Plate No. 3.

Oil Companies Find . . .

Individual Well Records Beneficial

By WARREN L. BAKER

INDIVIDUAL well records of production, down-time, equipment, repairs, cost and detailed information have proven beneficial to several companies that have used systems of this kind during the past year. These records enable easy determination of the profitable basis of each well and analysis of down-time causes.

Records of production costs, in the past, have been compiled by leases and not by individual wells. This method left considerable guess work as to the profitable status of individual wells and in many cases a large lease would appear unprofitable when with the exception of a well or two the unit might be operated as a revenue earner.

Individual well cost accounting systems make possible the actual cost in dollars and cents as compared with the earnings of the well, which comparison enables the operator to determine just which wells he should abandon, and informs him just when a previous profitable well has reached a non-earning stage.

At this time companies employing the system are abandoning a number of wells that they have found unprofitable to operate. Some wells are being shut down temporarily because of market conditions, or shut down for possible future deepening. Other wells are being cleaned out or being equipped with modern machinery to put them on a profitable basis.

A very important feature of keeping a record on individual wells is the analysis of down-time troubles. It has been found that very often a thorough check of the equipment and operating conditions may disclose some cause of shut-downs, and usually this situation can be remedied to a large extent so that shut-downs are less frequent and the well therefore more profitably operated.

Several companies now keeping individual well records are more interested in using the system as an indicator of producing troubles. Amerada Petroleum Corp. uses the system primarily for this purpose and its engineers and superintendents are discovering many valuable results from being able to better conditions under which equipment works. Whenever a well is having abnormal producing troubles a thorough check of its equipment is made to determine if possible the cause of the trouble. Often old worn out equipment is found to be damaging other producing equipment.

The records also form a comparison sheet between different types of equipment as they operate under various conditions and in the future will probably be valuable purchasing guides that may change the buying policies of many companies. The reports will be valuable to manufacturers in that they will give an actual performance record of the company's products, and will be just as important to engineers and superintendents in equipping future developed properties.

Skelly Oil Co has an elaborate

SUMMARY OF WELL EXPENSE

DISTRICT ..... DATE .....

LEASE ..... Top Pay.....Bottom Pay.....

WELL NO. ..... Total Depth.....

.....Casing Set.....

EMULSION REPORT

.....B. S.....Water, Length of Stroke....., Strokes Per Minute....., Hrs. Pumped.....

ESTIMATED COST OF MATERIAL

Cups	$.....	Counterbalance	$.....
Balls and Seats	.....	Belt	.....
Pump	.....	Motor or Engine	.....
Tubing	.....	Clutch	.....
Sucker Rods	.....	Rig or Rig Front	.....
Rod Line	.....	Miscellaneous	.....

Total Estimated Cost of Material $.....

ESTIMATED COST OF LABOR

.....Man Hours at.....per hour $.....

.....Tractor Hours at.....per hour .....

Misc. Labor ....

Total Estimated Cost of Labor $.....

ESTIMATED PRODUCTION

.....Barrels Water Daily .....Barrels Oil Daily

Estimated Production for.....days at.....Bbls. per day .....Bbls.

Less:—Estimated Lost Production .....Bbls.

Less:—Royalty .....Bbls.

Estimated Net Production..... .....Bbls.

SUMMARY

Value of.....Bbls.....gravity, oil @ $.....per Bbl. $.....

Estimated Cost of Material $.....

Estimated Cost of Labor .....

Total Expense $.....

Estimated Profit / Loss ..... $.....

REMARKS

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detailed system of keeping its individual well records, but has found it a paying service. The company has a special department for the work, which uses its system as a cost accounting record. The department has been quite successful in eliminating unprofitable wells and in determining causes of troubles in many others. The amount of water and oil that each well produces is used to determine the amount of money that may be spent to an advantage in producing the unit.

The system was started by making a complete inventory of the equipment on each well. This inventory was quite complete, including all subsurface equipment and surface equipment, its size, amount and condition. With this information compiled it is easy to keep a complete service record and cost on each piece of equipment and compare it to the revenue from the well.

Each time a well is off production or some repairs are made, the field man reports the job to the division or district clerk. This report states the cause of the trouble, conditions found, material used, source of material, amount of down-time, men employed and other general information on the equipment. This information is compiled at headquarters on a large ledger sheet of paper, which has only one well on both sides, with the date. All expenses of this nature are charged up against this particular well. When this information is compiled in this manner it is easy to determine the cost and also the causes of down time. From time to time a summary of the well expense is made from this ledger sheet. This summary includes emulsion report, estimated cost of material, estimated cost of labor, estimated production and a summary of costs.

Whenever trouble is found in some particular operation or part of the equipment and a thorough inspection does not determine any cause, the case is called to the attention of the supply company from whom the equipment was purchased. Often, to the satisfaction of both parties, some remedy for the situation may be located.

An example of where good results have been obtained in lowering cost is the case where five complete 3000 foot strings of rods were being bought every eight months for a well. After the trouble was determined and the well properly counterbalanced, the rod trouble was reduced so that only 2000 feet of rods were used in the last six months.

A very important part of each record is that it is necessary that actual facts and not estimates be used. In keeping such a system this is probably the most important feature, since estimates are not true indications of the troubles and costs of operating a well nor in determining the cause of down time.

These records not only keep headquarters familiarized with conditions in each district, but are also kept on file in each district superintendent's office and enable him to become more familiar with conditions in his territory and therefore to better operate the properties.

SKELLY OIL COMPANY

EQUIPMENT AND OPERATING REPORT

DISTRICT .....DATE.....

LEASE .....WELL NO.....

CAUSE OF TROUBLE [State Why Well or Other Equipment Was Shut Down].....

.....

.....

.....

CONDITIONS FOUND: [State Clearly in Detail, Size, Make and Condition of Material or Equipment Taken Out of Service].....

.....

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MATERIAL USED: [State Size, Quantity and Make. Also Whether New or Second Hand]

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.....

.....

SOURCE OF MATERIAL.....

GENERAL REMARKS: [Any Additional Information or Suggestion for Helping Conditions]

.....

.....

.....

PUMP SET AT.....PERFORATION SET AT.....TOTAL DEPTH.....

LENGTH MUD ANCHOR.....LENGTH GAS ANCHOR.....

WAITING HRS.....PUMPING HRS.....PUMPING HRS. LOST.....

TRACTOR NO.....USED.....HOURS.....

NO. OF MEN USED ON JOB.....NO OF HRS. TO COMP. JOB.....

NORMAL OIL PROD.....WATER PROD.....ESTM. LOST PROD.....

NO. OF STROKES PER MINUTE.....LENGTH OF STROKE.....

Reported by.....

Checked by.....

THE PETROLEUM INDUSTRY IN ITALY

By G. B. ANTONELLI, *Petroleum Engineer, Genoa, Italy*

IT IS only of late years that Italy has interested herself to any great extent in the petroleum industry, having until a short time ago limited her activity to prospecting for the oil fields.

Of all the work done with the aim of discovering crude-oil, which is thought to exist in Italy, never have satisfactory results been given.

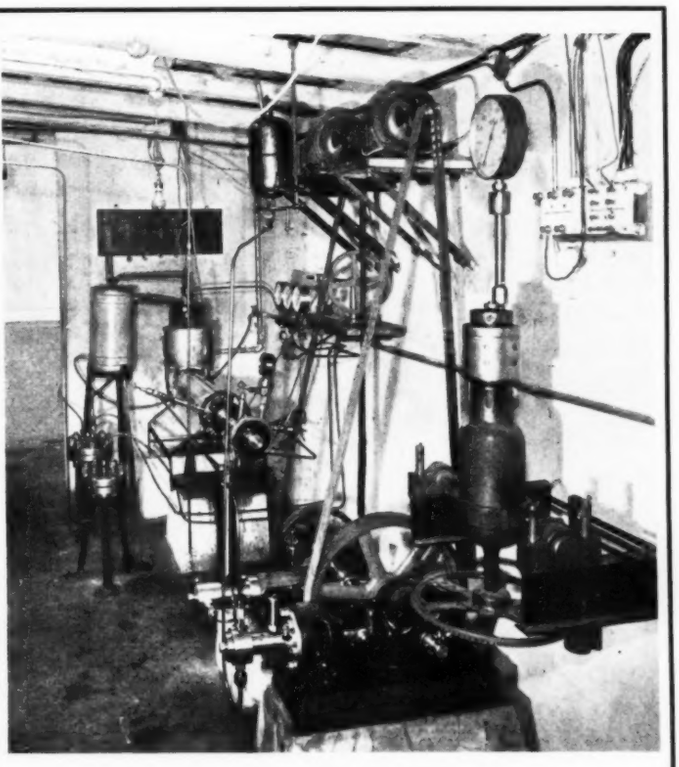
Before the great war only two companies were able to develop with some result their cultivations, viz.:

"The Petroli d'Italia S. A." (see Note 1) which drilled many wells during the several years of its prospecting in the Provincia of Piacenza (the deepest of metri 1153), and that lately has begun to drill in the Provincia of Frosinone. The results obtained lately by the organization has not been very successful.

"The Petrolifera Italiana S. A." (see Note 2), a younger company whose activities have been confined to the Provincia of Parma.

However, seeing that the program of these two societies is naturally limited to private interests, the Government of Mr. Mussolini (which considers it very important and urgent to know if it is possible to rely upon a national production of crude-oils) promoted in 1926 the constitution of the "Azienda Generale Italiana Petroli" (A. G. I. P.) (see Note 3) charging it with the program of systematic prospecting in any part of the country where indications gave hope of finding this precious liquid, and gives to the said society a subsidy of about Lire 7,800,000 yearly.

The A. G. I. P., whose active director, Mr. Ing. Amoretti, was the director of "The Petroli d'Italia", carries out a very careful study for intelligent prospecting in several parts of the country, and it has begun to drill at Bivona, Abbatteggio, S. Colombano, Gangi, Podenzano, and in many places of the Provincia of Parma.



Engine Testing Laboratory

The numerous wells drilled in Italy have given up to now no important production of crude, being exhausted after a very short time. Thence, in spite of the great number of wells in activity, the Italian production is as yet a production in its infancy. The Italian Government, while stimulating the prospecting for crude-oil, created in September, 1926, a center for the study of any question relating to the petroleum industry and fuel products. This center is today a section of the "Instituto di Chimica Industriale" of the "Politecnico di Milano." It is under the direction of Mr. Prof. Levi, and is provided with all that is necessary for its object.

Before the World War, the Italian petroleum industry was of no importance, since there were two small refining plants (one belonging to the "Petroli d'Italia" and the other to the "Petrolifera Italiana" and both working the crude produced respectively by these two societies), and a small plant of the "Asfalti Bitumi Catrami & Derivati S. A." (see Note 4) for the extraction of petroleum oils from the asphaltic rocks of Ragusa (Sicily), and many small plants for the production of the lubricating oils from American products. After the annexation of Trieste and Fiume to Italy, after the World War, the Italian petroleum industry was enriched with the refineries existing in these localities (see Note 5).

The Italian Government, besides promoting petroleum activities and trade through the A. G. I. P., also facilitated the financing of the Fiume refinery (which has in such a manner become powerful) and has lately granted particular custom-duty favors for the introduction in the kingdom of the stocks to be worked in cracking plants.

For these reasons the petroleum industry is sensibly advancing in Italy, and many plants similar to those already existing will be built augmenting the national production of the by-products.

It is thought that the A. G. I. P., which today monopolizes the greater part of the Italian refineries and cracking plant production, will buy also the future production, becoming in this manner more and more important in the Italian petroleum trade-market (see Note 6). It will be then in better condition for competing with the "Italo-Americana S. A." (of the "Standard of N. Jersey"), with the "Nafta S. A." (of the "Royal Dutch-Shell"), and with the Russian sellers ("Petrolea S. A. I."), which last have almost finished the construction of their storage plants near Savona

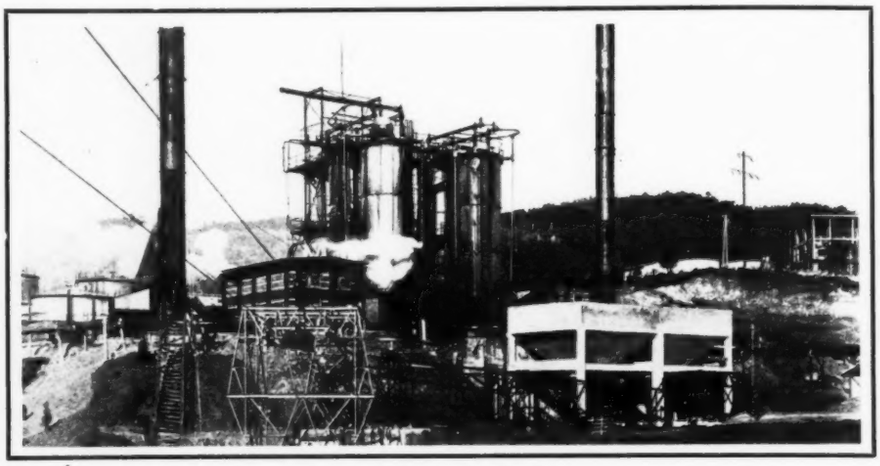
(Genoa). The competition of the "Petrofina" (of the "Compagnie Francaise des Petroles", and the strongest-suit of the French policy regarding the petroleum trade and industry) may be foreseen also for Italy. Of all these competitors, only the "Nafta" and the "Petrofina" interested themselves in the Italian Petroleum industry, whilst the "Italo-Americana" is only a calm spectator and the Russian sellers are not yet interested in this direction.

Instituto per lo Studio dei Combustibili

This institute, created by the Government, began to work during the last months of 1926 under the direction of Mr. Prof. A. M. Levi. The year after it was removed and annexed to the "Scuola Superiore di Ingegneria" of Milano, in which it is a section of the "Istituto di Chimica Industriale", always under the direction of its esteemed director, Mr. Levi.

This institute is well and fully equipped to fulfill any experiment or study, even the hardest, in the solid, liquid and gaseous fuel matter.

While it carries out a program of its own, regarding any study of interest to the country, it also effects any experiment or study the private people may ask concerning the fuel products.



Modern Cracking Installation

Referring to the petroleum products, the laboratory annexed to the institute possesses the apparatus necessary to experiment with the cracking and hydrogenation processes.

It possesses suitable equipment for the catalytic synthesis up to the pressure of 250 atm. and the temperature of 1000 C., and for the study of the cracking and hydrogenation processes inside a closed container up to the pressure of 1000 atm.

The materials for study and experiments with cracking and hydrogenation processes are furnished by the national coal-fuels, by the pitch and tar obtained with the national distillation of whatsoever fuel, and by the distillation of the asphaltic rocks.

Likewise the natural gases which arise in many localities of the country furnish this institute with an important matter for study with the aim of their eventual utilization, seeing that, until today, they have been neglected in Italy.

Refinery of Fiume

This refinery belongs to the "Raffineria Olii Minerali S. A." (R. O. M. S. A.) and is controlled by the Government.

It was completed in 1929 with one unit of the Holmes-Manley cracking process and with a tar-stripper plant. This Holmes-Manley unit is provided with four reaction-chambers of a diameter of m. 1.50, and a length of m. 12, made of molibdenum steel of a thickness of mm. 63.5 and welded with the water-gas hammer method.

This refinery treats today the crude of Grosny.

First the crude is handled by the following operations: The crude, through a heat-exchanger, enters by means of a steam pump into a battery of six coal-fired shell-stills (crude-stills) where it is distilled. In the heat-exchanger the crude is previously heated by the vapors discharged from the crude-stills inside the coils it contains. A first partial distillation of the crude already occurred in the heat-exchanger obtaining light gasoline. From the condensation of the vapors discharged out from the crude-stills, gasoline and kerosene and gas-oil are obtained.

The hot residuums of the crude-stills are directly discharged into the battery of vacuum shell-stills and stripped to a heavy asphalt, which is run to dry coke in two batteries of still (coke-stills). The gas-oil obtained by distillation in the crude-stills, the paraffin distillates stripped off by vacuum and by the coke-stills, and some heavy gas-oils which proceed from the tar-stripper, blended all together constitute the charging stock for the cracking process.

This charging stock is delivered by a pump and to a pressure of 20 atmospheres, through a heat-exchanger to circulate in the tube still inside the furnace, where it is heated until attaining the initial cracking temperature.

Thence, so heated, it runs into the reaction-chambers that characterize the Holmes-Manley process.

The vapors of that reaction-chamber are brought into a fractionating tower where they are partially condensed. The non-condensed vapors, through the coils of the said heat-exchanger, rejoin the gas separator.

There the gasoline is brought to its storage tank, whilst the gas is used both to heat the central side of the reaction-chamber, and to burn in the fire-box of the furnace.

The vapors which condense on the bottom of the fractionating-tower are brought, by means of a pump, into the coils of the furnace, whilst those condensed in the reaction-chambers will furnish the charging stock for the tar-stripper plant.

This last residuum enters into an expansion-chamber where, owing to the great fall of pressure, it partially evaporates.

The vapors so obtained are brought inside the fractionating columns from which are obtained heavy gasoline and gas-oil, whilst the condensated residuum forms the fuel-oil that will be burned in the furnace.

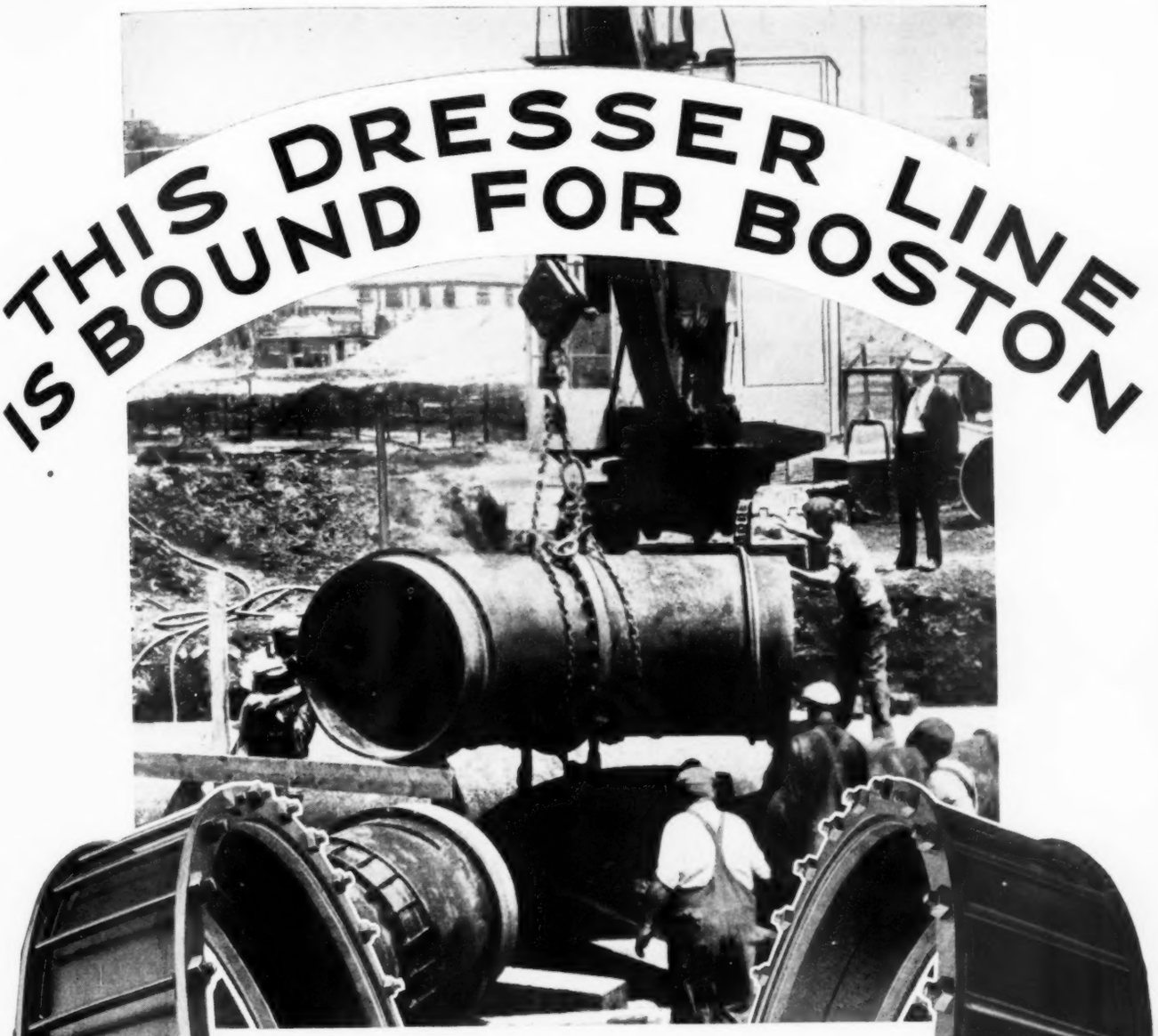
Before the plant of cracking was adopted and installed, the paraffin residuums were dewaxed and then rerun several times to obtain various grades of light and medium lubricating-oils.

The gravity of the charging-stock to be cracked is of 0.870/0.900. The temperature of the cracking operations is of 420/430 C., and the pressure near 20 atm.

This charging-stock is about the 55 per cent in weight of the crude treated in the refinery, and its yield is the 60/62 per cent in volume of the charging-stock.

The cracked gasoline is treated with sulphuric acid.

THIS DRESSER LINE IS BOUND FOR BOSTON



In both natural and manufactured gas distribution from New England to Texas, and from Florida to Washington—Dresser Couplings are the one most commonly used pipe line accessory. Probably more than 100,000 miles of Dresser Coupled pipe are in service, maintained satisfactorily at pressures from 250 to 500 pounds. « « « « «

DRESSER COUPLINGS DOMINATE

S.R. DRESSER MANUFACTURING COMPANY, BRADFORD, PA.

When writing S. R. DRESSER MFG. CO., *please mention The Petroleum Engineer*

Cracking Plants

Three plants for cracking have been lately built under the protection of the above-mentioned Law re. the custom-duty favors of the Government to the stocks they work.

These plants belong to the:

"Societá Benzina Italiana S. A." of Napoli (B. E. N.I.T.), whose capital of Lire 15,000,000 is controlled by the "Petrofina", which possesses the greatest part of the shares.

"Distillazione Italiana Combustibili S. A." of Venezia (D. I. C. S. A.), having a capital of Lire 15,000,000—totally subscribed by Italian people.

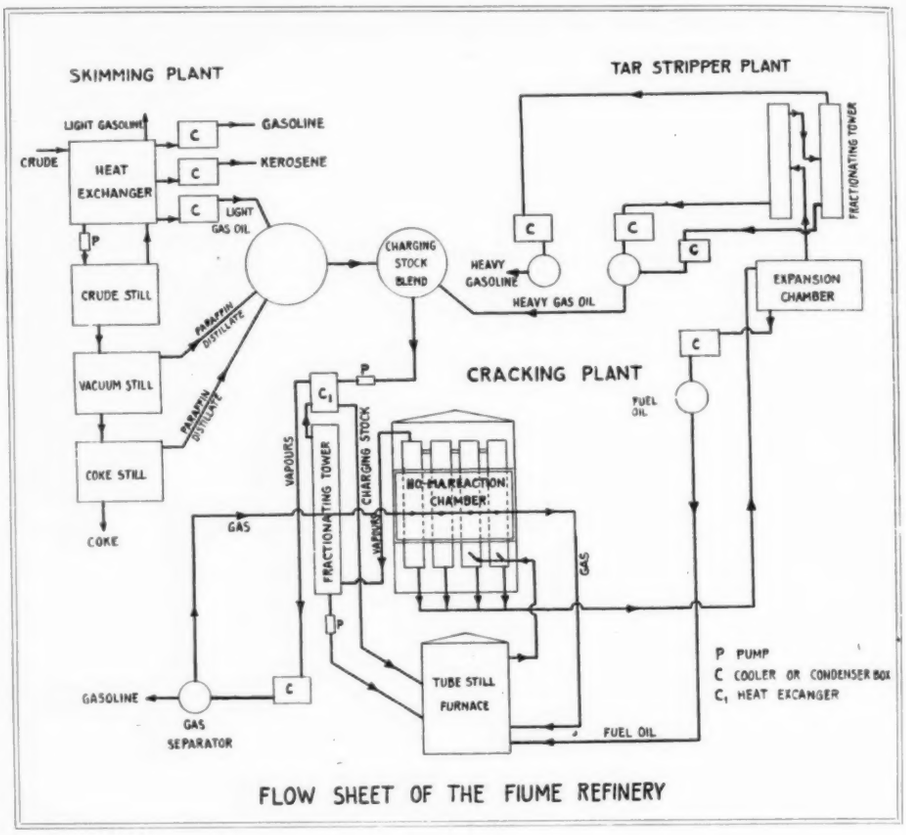
"Societá per l'Industria Italiana del Petrolio S. A." of Spezia (S. I. I. P.), whose capital of Lire 45,000,000 is controlled by the Royal Dutch-Shell, which possess all the shares.

The plants of the S. I. I. P. and of the B. E. N. I. T. are already working regularly, whilst the plant of Venezia will shortly be ready to work.

The stocks treated today by the plants of the B. E. N. I. T. and of the D. I. C. S. A. are Russian residuums, and the plant of the S. I. I. P. treats the Rumenian Pacura.

The production of the B. E. N. I. T. and of the D. I. C. S. A. are sold to the A. G. I. P., whilst the production of the S. I. I. P. is sold to the "S. A. Nafta" (the Italian commercial company of the Royal Dutch - Shell), which has one of its storage plants very near to its works.

The characteristics of these plants of cracking are the following:



FLOW SHEET OF THE FIUME REFINERY

Cracking Plant of the S. I. I. P.—

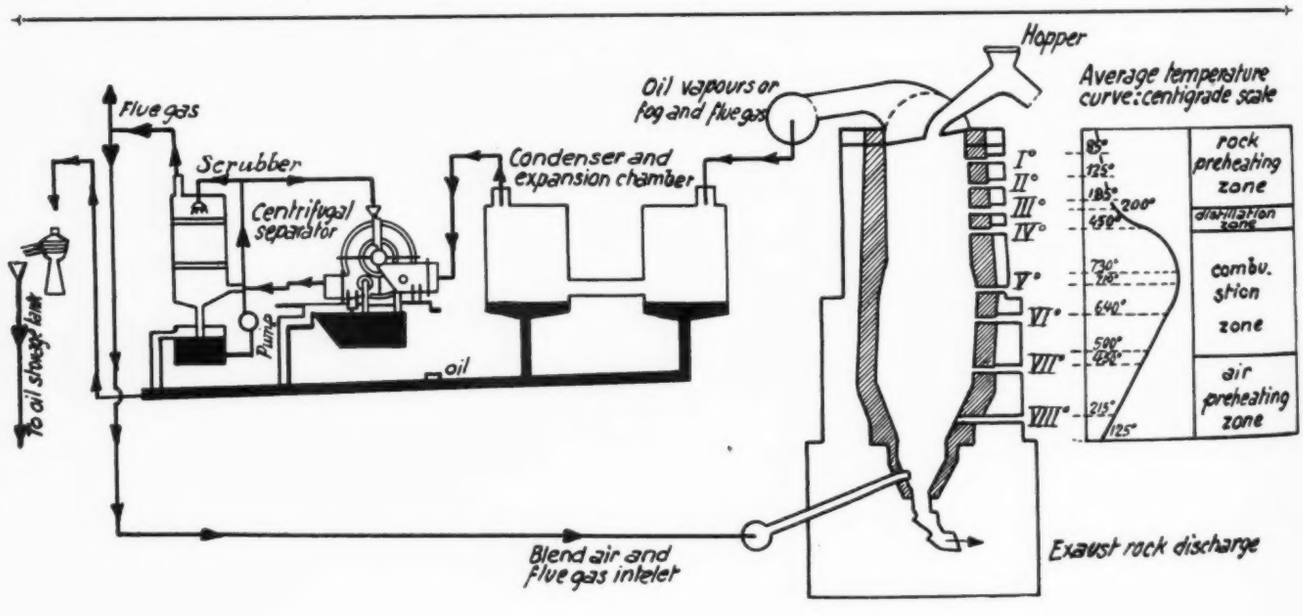
2 units each of 1,000 bbls. day nominal capacity.

1 furnace per unit—each with 72-4" O. D. convection tubes, and flue gas recirculating system.

2 reaction chambers per unit, electric-welded, 10' diameter x 30' high x 2" wall thickness for operating pressure of 200 lbs. square inch.

1 dephlegmator per unit—electric-welded—4'6" diameter x 43'6" high x 1½" wall thickness.

1 reflux or hot oil pump per unit—18"x10½"x24".



FLOW SHEET OF THE RAGUSA ROCKS DISTILLATION

LUFKIN RIG EQUIPMENT

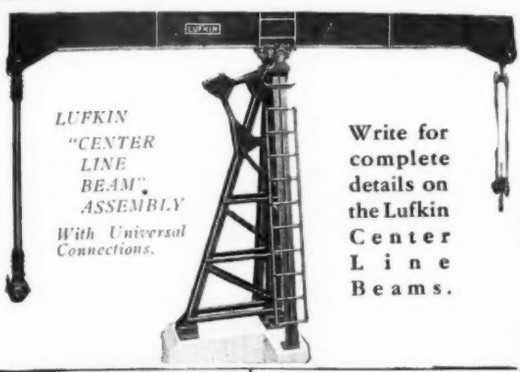
5 YEAR GUARANTEE AGAINST BEAM BREAKAGE

-WRITE FOR FULL PARTICULARS

Lufkin No. 1 Beams are guaranteed for five years against breakage.

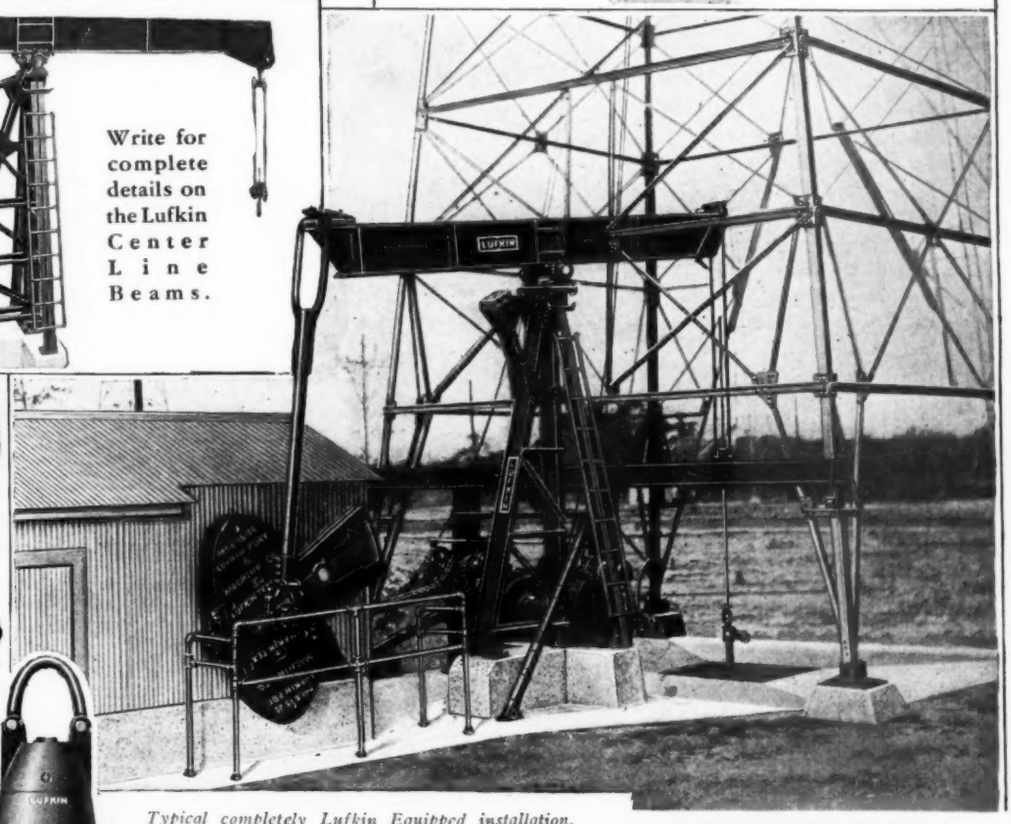
LUFKIN POST ASSEMBLY

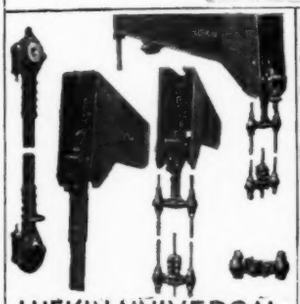
Consists of Lufkin self-supporting samson post, Lufkin I-beam type walking beam, Trout Universal Oil-Bath Pitman. Lufkin Assemblies work on any size derrick. Any type hoist or draw works can be installed without interference.



LUFKIN "CENTER LINE BEAM" ASSEMBLY With Universal Connections.

Write for complete details on the Lufkin Center Line Beams.





LUFKIN UNIVERSAL BEAM CONNECTIONS.

Lufkin Stream Line combination swivel, rod line weight and "C" link with roller bearings in drum.

Lufkin, Dust-Proof, Oil-Bath Center Iron, heavily constructed for long life requiring practically no attention.

Typical completely Lufkin Equipped installation.

Rig Equipment of Outstanding Merit

Lufkin Rig Equipment is used wherever oil is produced. Designed particularly for use with Lufkin Units, Lufkin Rig Equipment will be found readily adaptable to "Standard Rig" operations.

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»»»»» Branch Offices and Warehouses «««««

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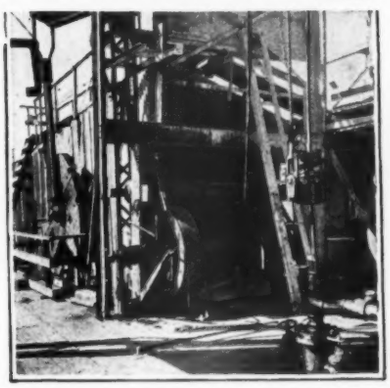
Inquiries addressed either to home office or branches will receive immediate attention.



Typical "Standard Rig" equipped with Lufkin Trout Counterbalance crank, pitman, beam and Hoist. A California installation.

These units are not equipped with a residuum flashing system.

Cracking Plant of the B. E. N. I. T.—

2 units each of 800 bbls. day nominal capacity.
2 furnaces—each with 62-4″ O. D. convection tubes and flue gas recirculating system.
1 reaction chamber per unit—electric-welded—10′ diameter x 30′ high x 2″ wall thickness for operating pressure of 200 lbs. square inch.
1 dephlegmator per unit—both electric and hammer welded, 3′6″ diameter x 21′2″ high x 1¼″ wall thickness.
1 reflux or hot oil pump per unit—16″x9″x18″.

Each unit is equipped with an individual residuum flashing system.

1 unit of 800 bbls. days nominal capacity.
1 furnace equipped with 50 radiant and 11 convection—4″ O. D. tubes.
1 reaction chamber electrically welded, 10′ diameter x 30′ high x 2½″ wall thickness for operating pressure of 250 lbs. per square inch.
1 dephlegmator, electric welded, 3′6″ diameter x 28′ high x 1″ wall thickness.
1 reflux or hot oil pump per unit—16″x9″x18″.

This unit is equipped with a residuum flashing system.

The production of these plants during 1930 was as follows:

S. I. I. P.....tons 36,000 of gasoline
B. E. N. I. T.....tons 30,000 of gasoline

The cracking plant of the B. E. N. I. T. treats a mazout of Baku having a gravity of 0.900. This mazout yields the 44 per cent in volume (viz., near the 37 per cent in weight) of gasoline of T.p. 200° C. Lately it has been possible to run continually during 1,144 hours.

Distillation of the asphaltic rocks of Ragusa—

The distillation of the asphaltic rocks of Ragusa (see Note 8) that was initiated in 1918 by the "Asfalti Bitumi Catrami & Derivati S. A." (A. B. C. D.) is becoming more important with the subsidy lately granted by the Government by means of a protective law.

The process adopted for such a distillation has been studied by the director of this society, Mr. Ing. Andrea La Porta.

These rocks are almost totally composed with carbonate of lime. The asphalt impregnating them possesses the following composition: 84.9 per cent of carbon, 11.7 per cent of hydrogen, 3.4 per cent of sulphur, so that its calorific power is very high. The diagram of the extraction proceeding is exposed in the enclosed flow-sheet.

The vapor and the fog of the oil of the unburned asphalt is drawn out by the current of the flue-gases and of the CO_2, due to the partial calcining of the lime.

Between the ends of the furnace there is a continual exchange of heat as shown in the flow-sheet.

The working of the furnace is continuous and the exhaust rock is discharged from the same through an iron door placed at its lower end. The blend of air and flue-gases enter into the furnace from below.

The flue-gases and the CO_2 of the lime and the vapor and fog of the oil go out through a pipe (on the upper end of the furnace) of a diameter about 2½′ entering the large condensing and expansion chambers.

These chambers are fitted with a series of plates against which the said blend repeatedly strikes so that there is a longer run owing to which the greater part of the blended oil falls down. Then the blend is drawn, by means of a disintegrator, into scrubbers leaving all the oil it still contains.

All the oil obtained by such a process is purified into centrifugal disintegrator and then delivered to four masonry storage tanks.

The temperature inside the furnace is controlled so as not to go above the 750° C., but 2/3 of the oil of the rock has been already evaporated at 450° C. With the temperatures allowed in the furnace, only 15-20 per cent of the $CaCO_3$ is transformed in CaO.

The heat of the flue gases is almost totally recovered in the furnace and some heat is also recovered heating the air entering into the same, so that all the heat developed by the amount of asphalt burned during the distillation is sufficient to the run of the process.

The A. B. C. D. is enlarging its plant at Ragusa to reach gradually the production of tons 50,000 yearly. Interests and depreciations included, the cost of the oil obtained by this society is estimated as from Lire 185—to Lire 225—per ton, according to the more or less high asphaltic value of the rock treated, which asphaltic value can be from a maximum of 20 per cent to the average of 6 per cent in weight.

The analysis of samples of the oil obtained by the distillations of the said rocks gave the following results:

Density at 15° C.	0,960/0,967
Engler viscosity at 20° C.	13,900/20,000
idem. 50° C.	2,400/3,500
idem. 100° C.	1,200/1,500
Flash point (P. M.)	120/126° C.
Engler distillation:	
till 300° C.	11.5/14%
300—350° C.	35%
350—380° C.	27%
residuum and losses	24%
Sulphur (Mahler)	2,190%

The A. B. C. D. posesses two little plants (near Rome and Ragusa) into which it distills and refines a part of the oil it produces, obtaining lubricating oils.

NOTES

1. Registered, May 29, 1906, with a share-capital of Lire 28.000.000 and today controlled by the "Banca Commerciale Italiana." Its production in 1930 was of tons 2.800.

2. Registered, July 16, 1905, with a share-capital of Lire 25.000.000, and today controlled by the "Standard Oil" of N. York. Its production in 1930 was of tons 3.800.

3. Registered, May 19, 1926, with a share-capital of Lire 140.000.000 (today), of which 60% has been subscribed by the Government and the residue by the "Instituto Nazionale delle Assicurazioni" and by the "Cassa Naionale." It issued in 1926 Lire 9.975.000 of 5% bonds. Two years ago the A. G. I. P. bought the "Sindacato Nazionale Olii Minerali" (S. N. O. M.), an Italian Society for the trade and the distribution of the petroleum products. The A. G. I. P. controls today in Roumania the following companies: "Prahova," which has a capital of Lei 300.000.000. and cultivates many oil fields. — "Petrolul Bucuresti," whose capital is of Lei 50.000.000.; that works a refinery. Today has a potentiality of 450 tons daily. — "Texas," with a capital of Lei 5.000.000. that is a transport company. The Prahova produced in 1930 tons 115.000. of crude oils.

4. Registered, December 15, 1917, with a capital of Lire 16.800.000.

5. The "Raffineria Triestina Olii Minerali," registered May 25, 1892, with a capital of Lire 10.000.000 (today), and controlled now by the "Standard of New Jersey," which possesses the refinery of Trieste that is working on lubricating oils. And the "Raffineria Olii Minerali S. A." of Fiume, registered April 28, 1922, with a capital of Lire 25.000.000, which possesses the refinery of Fiume, and that is today controlled by the A. G. I. P. In 1930 it produced tons 24.000 of gasoline.

6. Italian importations in 1930:

Crude Oils	tons	96.436
Kerosene	tons	156.536
Gasoline	tons	389.771
Residuums	tons	705.533

Supplyer countries:		(Kerosene)	(Gasoline)
United States	tons	21.188	141.653
Persia	tons	5.555	122.950
Roumania	tons	73.158	23.958
Russia	tons	55.035	72.387
Other	tons	1.598	28.821
Total	tons	156.536	389.771

7. These asphaltic rocks must not be confounded with the oil shales, seeing that the oils are obtained from the first by distillation only, whilst from the last with pyrogenic action on their organic compounds.

8. The asphalt limestones of Ragusa are well known in the United States, and yet many samples of these rocks were examined by Mr. M. Clifford Richardson, the results of which analyses he exposed in his treatise, "The Modern Asphalt Pavements."

CAPTAIN KIDD *was not a Pirate*

yet was hanged because of a misinformed public!

Waste refinery gases were once condemned as impractical for gas engine fuel. There still remains considerable scepticism.

If you have the least doubt, we will be glad to give you detailed information and refer you to actual operating installations.

With a TRANSIT Gas Engine driven Hot Oil Pump you have the utmost in reliability for the most particular of all services—that of pumping hot oil.

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OPERATING ON
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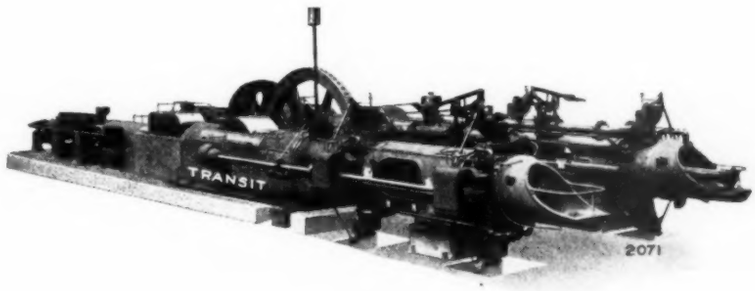

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SALT LAKE CITY, UTAH
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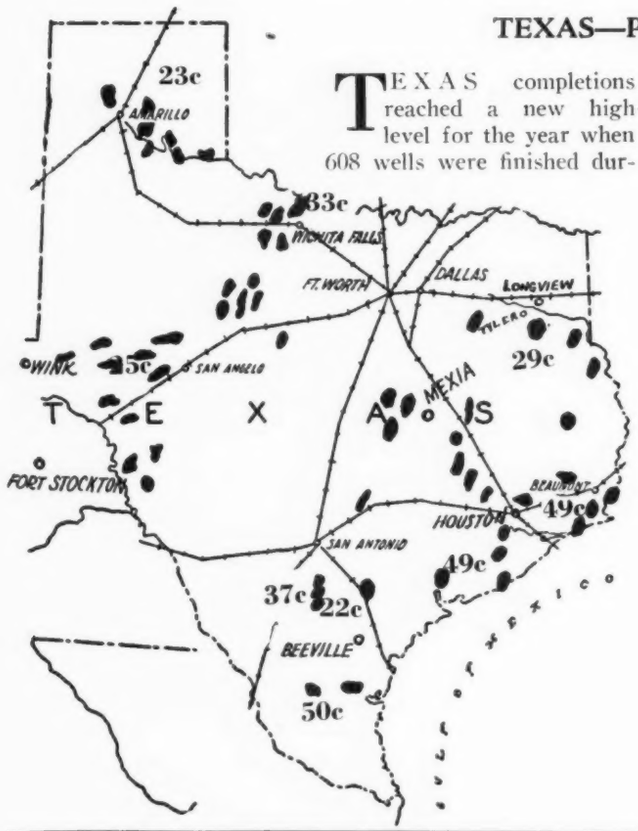
Latest Activities *in the* Oil Fields*

TEXAS—Production, 1930—290,720,000 Barrels



TEXAS completions reached a new high level for the year when 608 wells were finished during the month of May. Other activities of this state continue to be very high, with 693 drilling permits, 277 rigs and 870 drilling wells.

East Texas is the principal factor in the increased activity of the Lone Star State. The producing area of this region is constantly spreading and today is 37 miles long. The shallow producing depth is easily and quickly reached—a factor that is increasing the number of completions but is holding down the number of drilling rigs.

Following is a tabulated review of the active areas:

	POOLS			
	East Texas	Panhandle	Van	Refugio
Number of Permits	430	7	16	2
May Completions	311	35	12	11
Number of Rigs	180	14	5	1
Number Drilling Wells	297	20	6	12
Gravity of Oil	40	40	36	26
Depth of Production	3600	2900	2600	6500
Type of Tools Used	Rotary	Rotary	Rotary	Rotary
Number of Casing Strings	2	2	2	3

CALIFORNIA

Production, 1930—228,612,000 Barrels

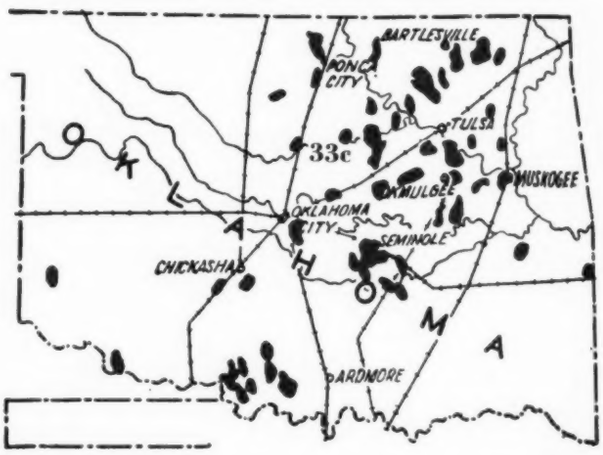
Activity in California continues to slump. The state has only 269 drilling wells and 31 rigs at this time. There were 35 completions and 45 drilling permits during the past month. Heavy restrictions indicate that the activity will not increase at any time soon.

Following is a survey of operations in the state's most active fields:

	POOLS			
	Playa Del Rey	Long Beach	Kettleman Hills	Ventura
Number of Permits	1	11	1	1
May Completions	7	6	2	8
Number of Rigs	1	4	1	1
Number Drilling Wells	11	26	21	7
Gravity of Oil	23	26	60	36
Depth of Production	6000	7000	8300	7800
Type of Tools Used	Rotary	Rotary	Rotary	Rotary

OKLAHOMA

Production, 1930—214,425,000 Barrels



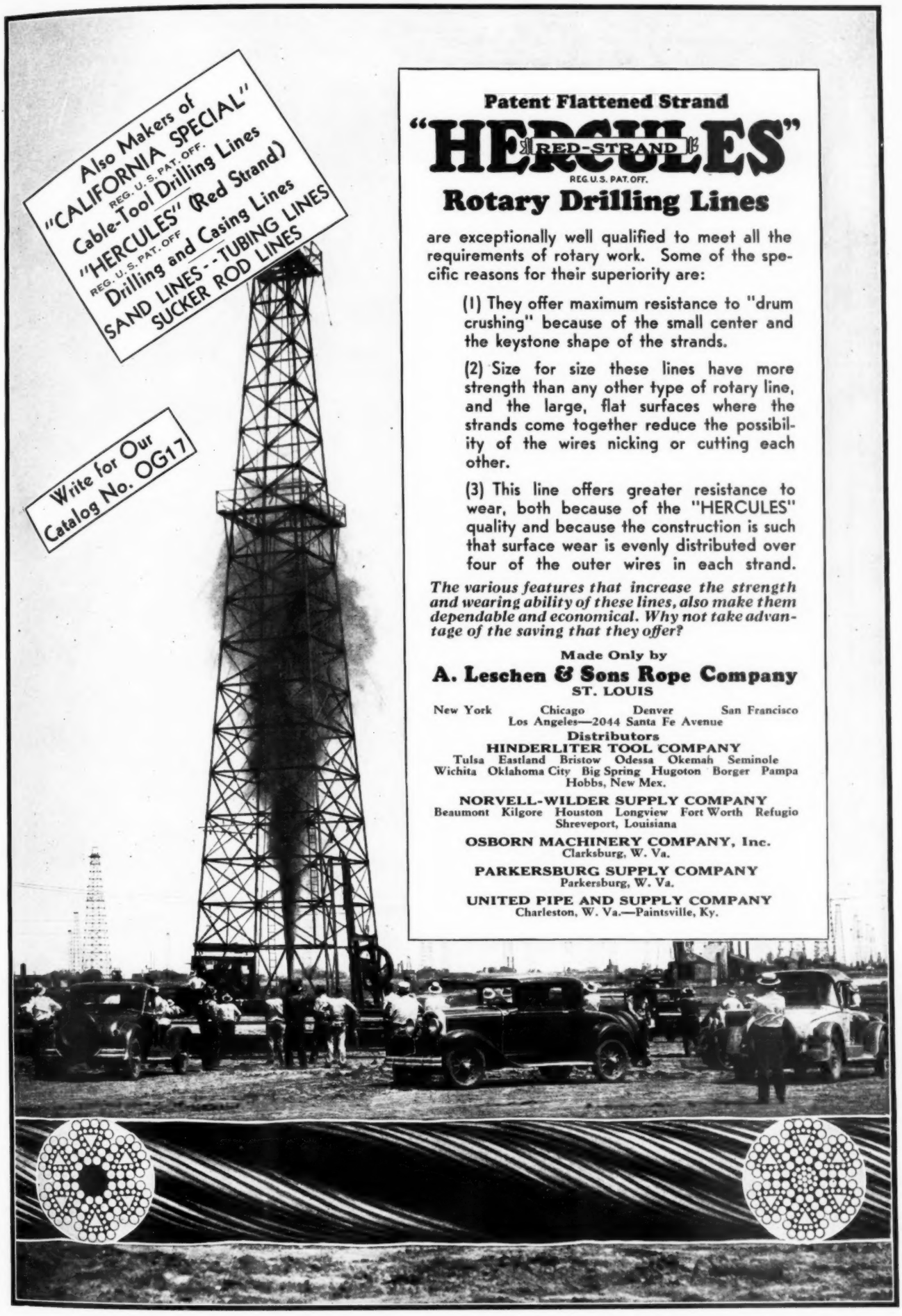
Lack of any new development leaves Oklahoma City the only field with much activity in Oklahoma, although operations in this pool are many times less than previously.

Following is a summary of Oklahoma's activity:

	Entire State	Oklahoma City
Number of Permits	78	18
May Completions	113	16
Number of Rigs	65	23
Number Drilling Wells	140	56
Gravity of Oil	36 (average)	39
Depth of Production	Varies	6400
Type of Tools Used	Cab.-Rot.	Rotary
Number of Casing Strings	Varies	3

* All statistics as of June 1st.
●Denotes oil and gas fields.

Figures on maps indicate average prices of crude oil per bbl.



Patent Flattened Strand

"HERCULES"

RED-STRAND

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Rotary Drilling Lines

are exceptionally well qualified to meet all the requirements of rotary work. Some of the specific reasons for their superiority are:

(1) They offer maximum resistance to "drum crushing" because of the small center and the keystone shape of the strands.

(2) Size for size these lines have more strength than any other type of rotary line, and the large, flat surfaces where the strands come together reduce the possibility of the wires nicking or cutting each other.

(3) This line offers greater resistance to wear, both because of the "HERCULES" quality and because the construction is such that surface wear is evenly distributed over four of the outer wires in each strand.

The various features that increase the strength and wearing ability of these lines, also make them dependable and economical. Why not take advantage of the saving that they offer?

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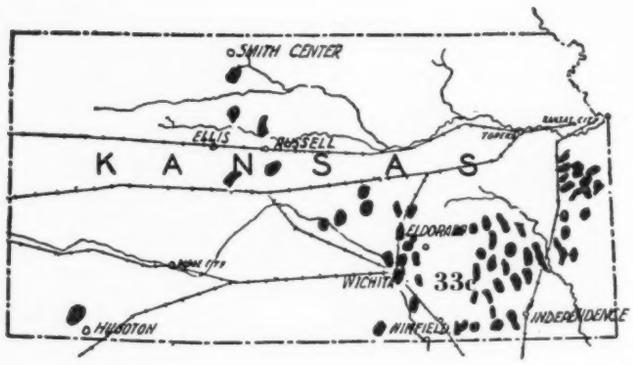
When writing A. Leschen & Sons Rope Co., *please mention The Petroleum Engineer*

KANSAS—Production, 1930—41,745,000 Barrels



Kansas had 48 permits and 31 completions during May, the end of which time saw 52 rigs and 72 drilling wells in the state. Both rotary and cable tools are used in this state, with the former predominating.

Following is a summary of the active fields:

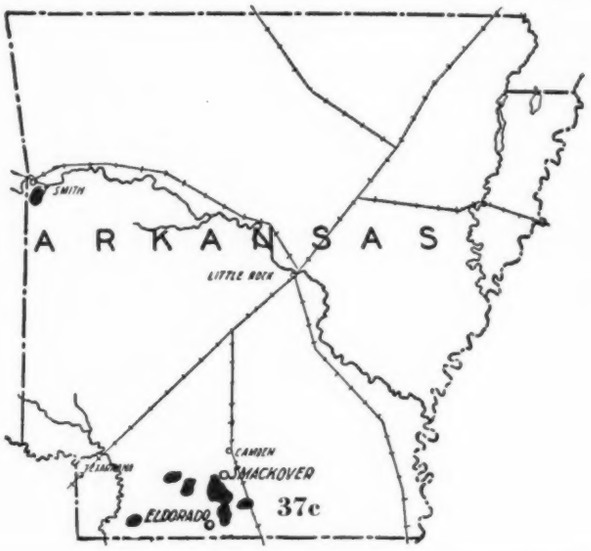
	POOLS		
	Sedgwick County	McPherson County	Hugoton Field
Number of Permits	2	29	7
May Completions	2	24	3
Number of Rigs	1	19	3
Number Drilling Wells	7	35	4
Gravity of Oil	36	37	Gas
Depth of Production	2900-3250	2900-3400	2750
Type of Tools Used	Cab.-Rot.	Cab.-Rot.	Cab.-Rot.
Number of Casing Strings	2	2	2

ARKANSAS

Production, 1930—19,680,000 Barrels

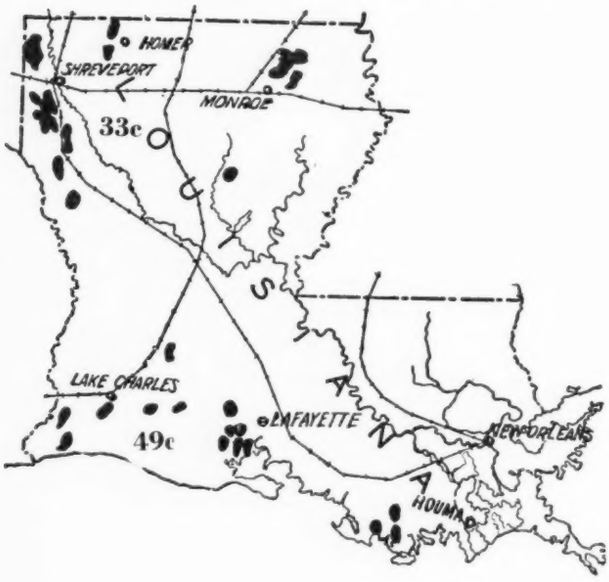
Arkansas oil field activity records show that during the month of May there were 6 permits and 15 completions, with 7 rigs and 35 drilling tests at the end of the month.

Rotary tools are employed by operators to do the drilling in the state, where heavy gas pressures and soft-cavey formations are frequently encountered.



LOUISIANA

Production, 1930—23,150,000 Barrels



Louisiana had 40 drilling permits issued and 46 wells finished during May. The state has 20 rigs and 90 drilling wells. Rotary tools are operated in the state.

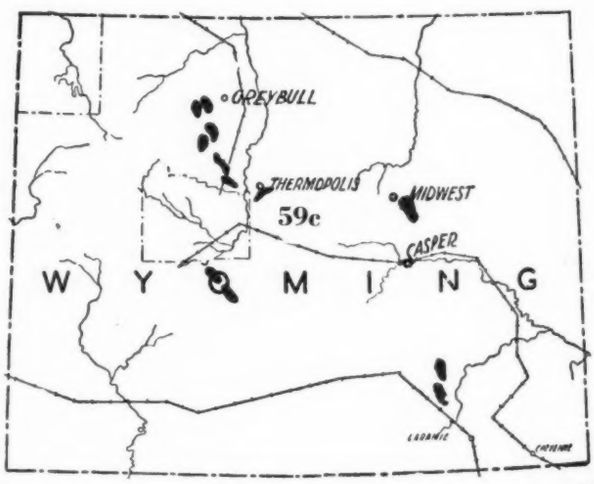
Mississippi, adjoining Louisiana to the east, had 6 completions last month, 6 rigs and 19 drilling wells. The play in Mississippi is centered around gas production at Jackson.

● Denotes oil and gas fields.

WYOMING

Production, 1930—11,177,000 Barrels

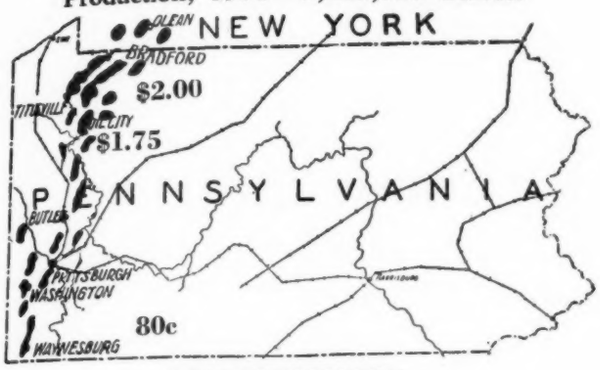
There were 8 completions in Wyoming last month. This state has 85 drilling wells and 10 rigs. Both rotary and cable tools are operated, with cable tool installations predominating.



Figures on maps indicate average prices of crude oil per bbl.

NEW YORK

Production, 1930—3,825,000 Barrels



PENNSYLVANIA

Production, 1930—12,810,000 Barrels

Pennsylvania showed 21 completions, 11 rigs and 42 drilling wells last month.

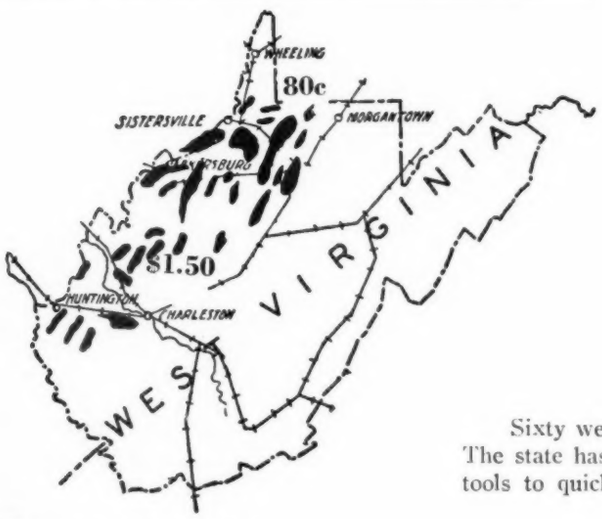
New York, with the Tioga gas field the center of interest, had 14 completions, 15 rigs and 40 drilling wells. Both states are drilled with cable tools.

ILLINOIS

Production, 1930—5,695,000 Barrels

There were no wells completed in Illinois the past month. The state had 3 rigs and 17 drilling wells at the end of the month.

All of the drilling in the state is done with standard tools, producing depths being shallow and offering no unusually difficult drilling proposition.

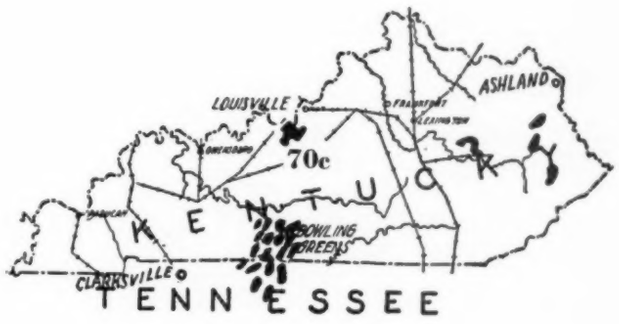


KENTUCKY

Production, 1930—7,300,000 Barrels

Kentucky had 18 completions, 12 rigs and 125 drilling wells during May. Tennessee had no completions or rigs and only 17 drilling wells.

Drilling in both states is accomplished with standard tools.



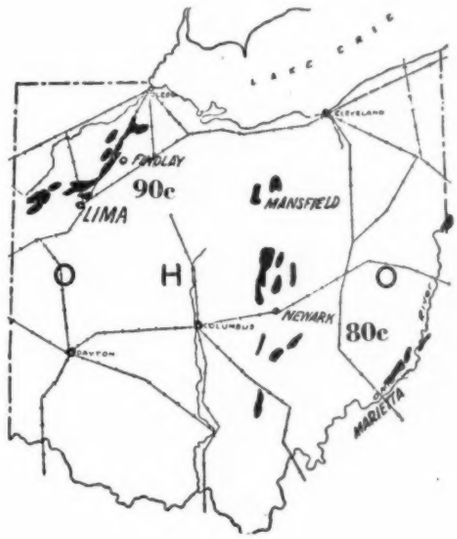
TENNESSEE

Production, 1930—20,000 Barrels

OHIO

Production, 1930—6,525,000 Barrels

There were 58 completions in Ohio during May. The state has 58 rigs and 153 drilling wells. Cable tools are utilized for drilling the state's tests.



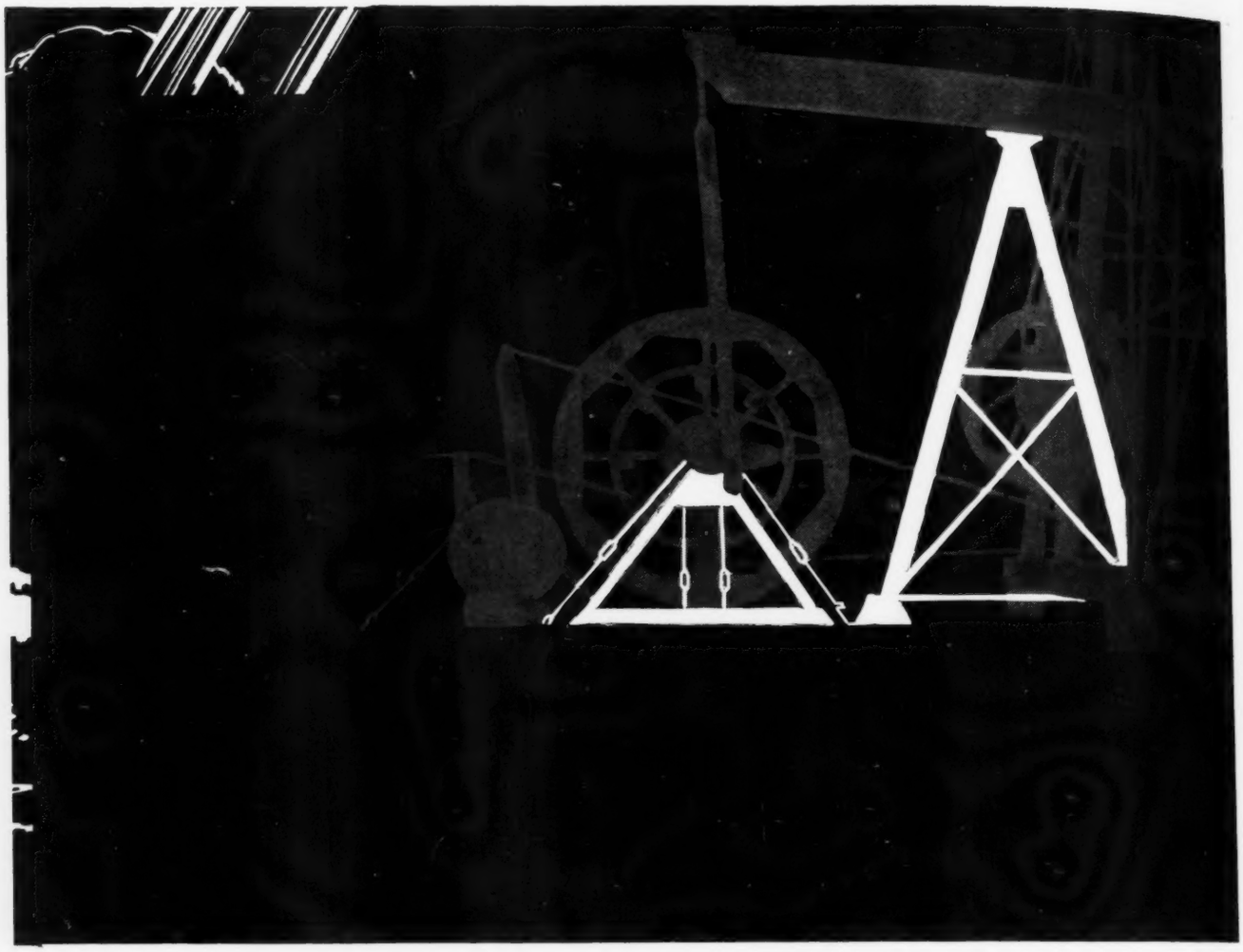
WEST VIRGINIA

Production, 1930—5,100,000 Barrels

Sixty wells were completed in West Virginia during the past 30 days. The state has 6 rigs and 45 drilling wells. Shallow depths permit cable tools to quickly finish all tests.

●Denotes oil and gas fields.

Figures on maps indicate average prices of crude oil per bbl.



WITH STRENGTH AND .... ENDURANCE

Moore Types 90 and 91 Steel Rig Fronts are built for the heaviest drilling and pumping service. The use of structural steel girder beams, careful bracing, heavy base plates and electric welding are but a few features of design and fabrication which account for the strength and rigidty of this equipment.

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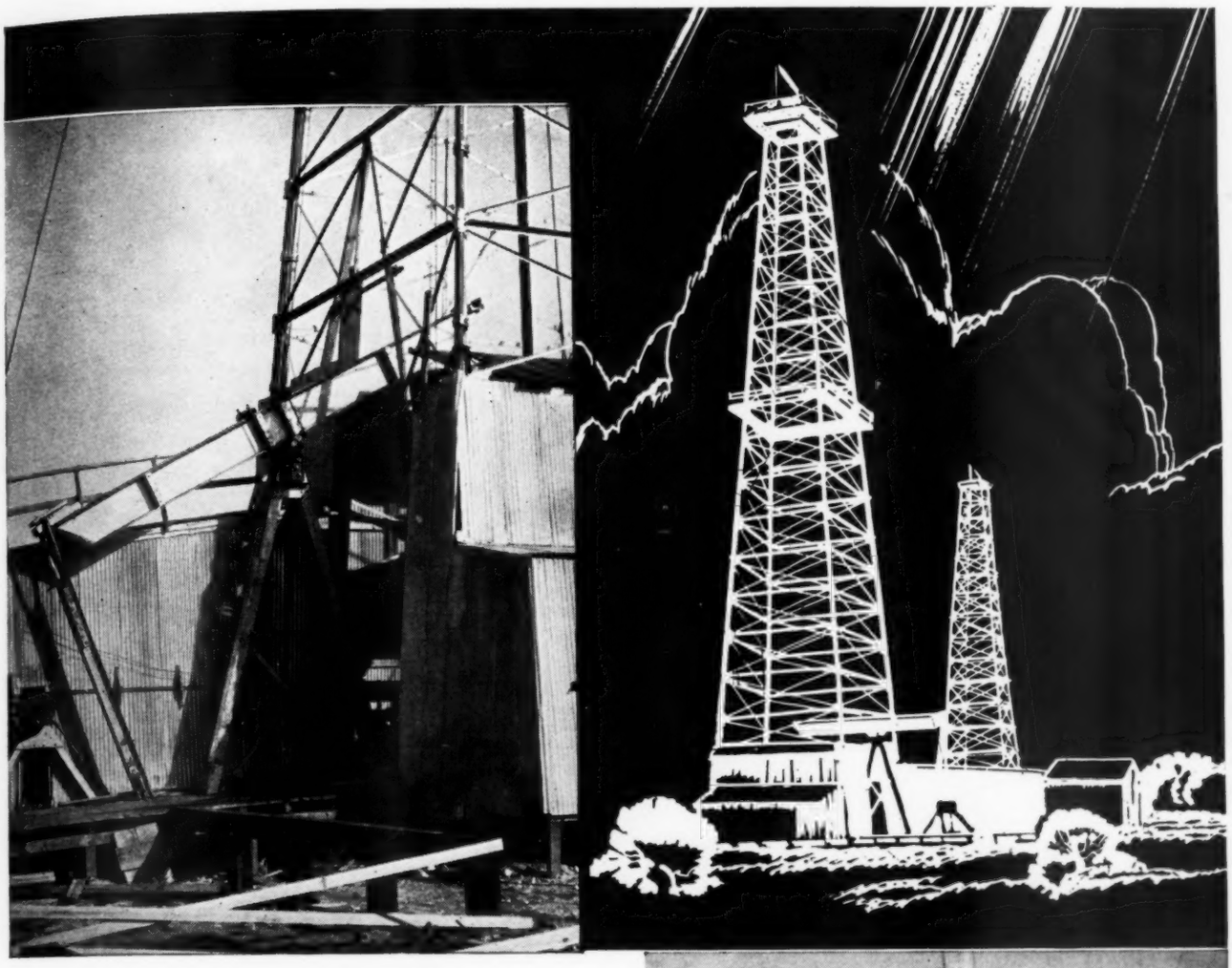
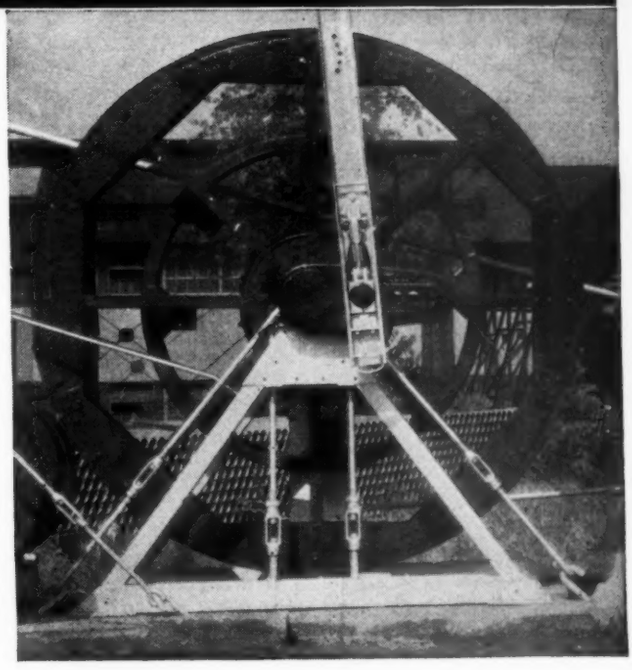
When writing Lee C. Moore & Co., Inc., *please mention The Petroleum Engineer*



The samson post is composed of two interchangeable 14" structural steel girder beams, made in the two A. P. I. heights. Headache post is made of an I beam, with adjustable top end.



Jack posts have angle ties between the bottom ends of the "A" legs. Diagonal turnbuckle braces and long turnbuckle hold-down rods for front bearing, and short hold-down rods for rear bearing, are standard equipment. Diagonal turnbuckle braces for rear bearing can be furnished.

RIG FRONTS

NEW MEXICO

Production, 1930—10,235,000 Barrels

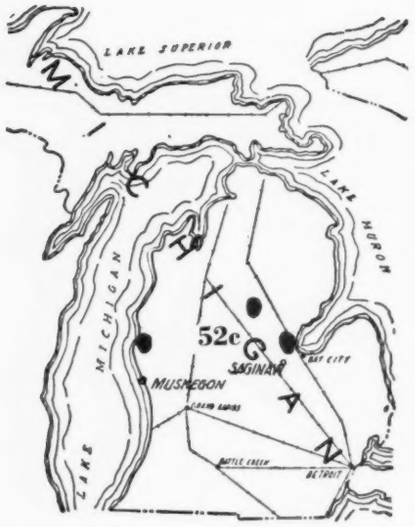
There continues to be a decline in New Mexico activity despite the fact it is far below its peak last fall. Last month there was only one completion, while the state has but 6 rigs and 45 drilling wells at this time.

The decline in activity is primarily due to the drop in operations at Hobbs, which field placed New Mexico in the limelight during the latter part of 1930.

Rotary tools are used in the Hobbs field and in drilling most of the tests in the southeastern portion, but many wells are drilled with cable tools in the state.

MICHIGAN

Production, 1930—3,525,000 Barrels



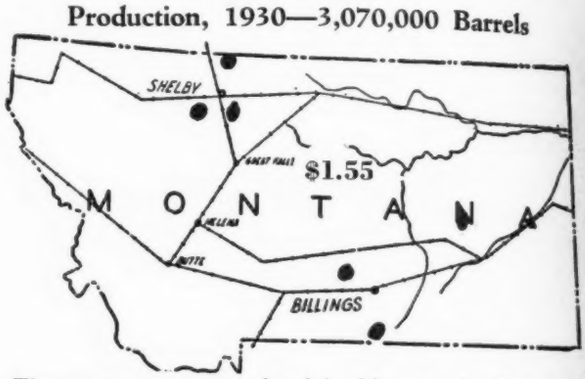
During the past month the state of Michigan had but 8 completions. A total of 99 wells are drilling in the state and there are 58 rigs.

Practically all of the wells in the state are drilled with standard tools.

● Denotes oil and gas fields.

MONTANA

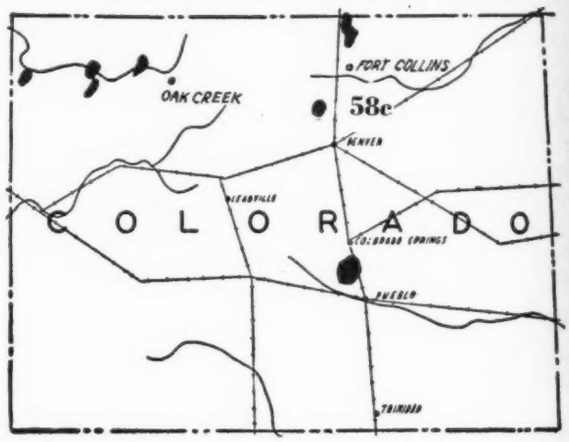
Production, 1930—3,070,000 Barrels



Three tests were completed in Montana in May, at the end of which time the state had 9 rigs and 55 drilling wells. Cable tools are the most common means of making hole in the state.

COLORADO

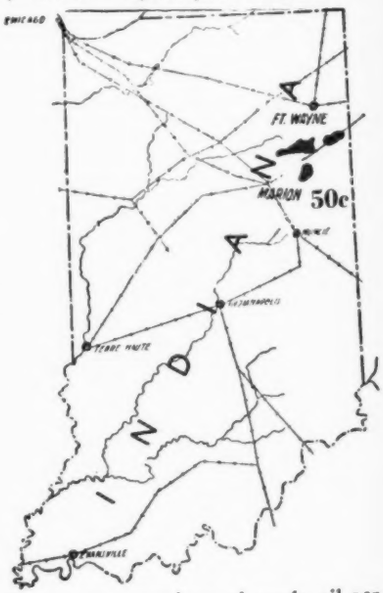
Production, 1930—1,644,000 Barrels



Colorado had four completions during the month of May. Drilling activity consists of 13 rigs and 70 drilling wells. Both rotary and cable tools are to be found operating in this state.

INDIANA

Production, 1930—1,000,000 Barrels



Indiana has 5 rigs and 51 drilling wells and during May had 13 completions. Cable tools are used by operators for drilling to the shallow producing depths.

There has been no unusually interesting development in the state for several months.

Figures on maps indicate average prices of crude oil per bbl.

[redacted] OIL COMPANY

[redacted] SOUTH [redacted] STREET

LOS ANGELES

November 3, 1930

Patterson-Ballagh Company
Insurance Exchange Building
Los Angeles, California

Attention Mr. J. C. Ballagh

Gentlemen:

About a year ago I reached the decision that we were paying too much for Bettis Protectors, having ascertained that I was not receiving the maximum discount and that to do so I was required to sign a contract, so I decided to place the business elsewhere.

During the ensuing several months I purchased practically all of the so called competitive brands for use in the various districts where our company was active, and without exception (regardless of the brand furnished or the location where they were used) the result was a growl from the field. The most prevalent complaints were that the amount of metal used in their construction caused too great a hazard, they could not be kept in place, and the service was very poor, etc.

In the meantime investigation revealed the number of Bettis users were so in majority that practically no competition existed, and the price was the same to all, depending only on whether or not a contract had been executed.

So, I decided to return to the fold as evidenced by the contract now in effect and everything is O.K. now.

Yours very truly,

[redacted]

PURCHASING AGENT.

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Progress of Major Pipe Line Work

By J. H. DAMERON

GREAT LAKES PIPE LINE CO.

MAJOR pipe line projects whose construction was started in 1930 and carried over into the present year are in the final stages of completion. These include the larger of the gasoline transporting systems and the largest of the natural gas transmission systems. In the meantime, the construction of other major projects is going forward rapidly and extensive pipe line work is being done in East Texas and in the construction of laterals to the newer major pipe line systems.

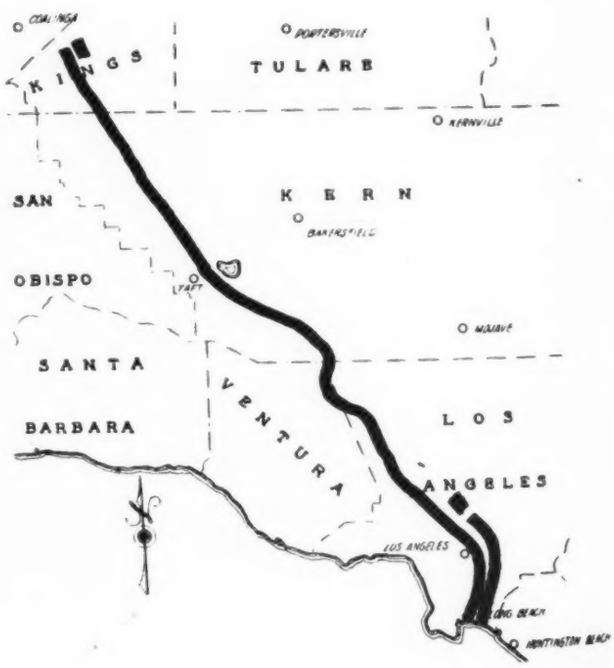
About July 1 the Great Lakes Pipe Line Co. expects to wind up construction work on its far-flung gasoline artery reaching into the Great Lakes region. The welded 8- and 6-inch line is complete from Muskogee, Okla., to the Twin Cities in Minnesota and the line is in operation as far north as Des Moines, Iowa.

Construction work on the 6-inch east from Des Moines to Chicago, Ill., is nearing completion. The line is being tested to the Mississippi river and the 6-inch north from Des Moines is also being tested. Contract for the 115-mile 4-inch welded lateral to Omaha, Neb., may be awarded sometime this month. The Diesel-powered, reciprocating pump stations are complete to Des Moines and the remaining stations are scheduled for completion by the first of July.

SOUTHERN FUEL CO.

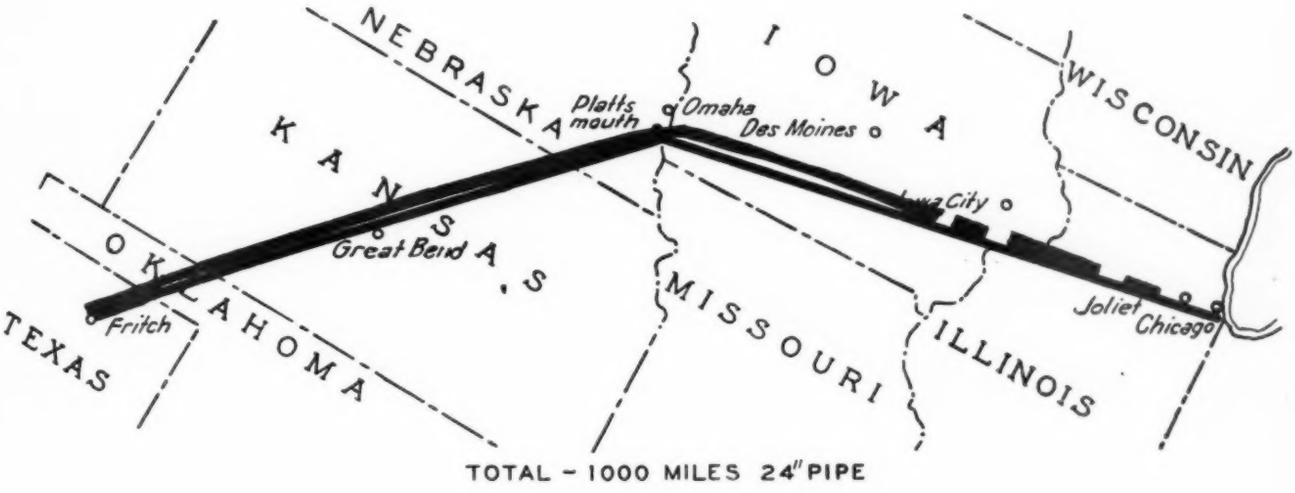
On the west coast the Southern Fuel Co., builders of a 185-mile, 26-inch natural gas line from Kettleman Hills to Los Angeles and Long Beach, has completed approximately 25 miles of line. Contract for the first section from Long Beach to Glendale was awarded to Lindgren and Swinerton. The second section, working north from Glendale, was awarded to the Macco-Robertson Co. About 16½ miles of this section will be electric welded by the Welding Engineering Co., Bartlesville, Okla.

Contracts covering construction of the balance of the line are expected to be made by July 1, and at least two additional crews will be at work by that time. No compressor stations will be erected until sometime in the future.



Indicates completed portion of line.
Indicates proposed route of line.

CONTINENTAL CONSTRUCTION CORP.



Continental Construction Corp.'s construction work in Iowa is expected to be completed June 15, leaving only the last schedule through Illinois to be completed on the nation's longest large-diameter gas line running from the Texas Panhandle to Chicago, Ill. The section through Iowa, which is combination welded and coupled, as is the rest of the line, was contracted to the Oklahoma Contracting Co. Ford Bacon and Davis, Inc., through Williams Bros., Tulsa contractors, are building the section through Illinois.

Station construction work is progressing rapidly, with the work at No. 1 station, the world's largest gas engine-driven compressor station, 35 per cent complete. No. 7 station in Iowa is 95 per cent complete, No. 8 in the same state is 70 per cent complete, and No. 9, also in Iowa, is 50 per cent complete. No. 10, in Illinois, is 25 per cent complete. The gasoline plant at Fritch is 25 per cent complete. Gas will probably be delivered in Chicago through this line by September 1. Approximately 500 miles of line have been tested and the major river crossings have been completed.

PANHANDLE-EASTERN PIPE LINE CO.

Panhandle Eastern Pipe Line Co., builders of the 1,100-mile combination welded and coupled gas line from the Texas Panhandle to Indianapolis, is nearing completion of that vast system which may eventually tie into gas mains extending to the Atlantic seaboard. Williams Bros., contractors, are finishing work on the last section of 22-inch through Illinois. This line is being built with 24-, 22- and 20-inch pipe.

The transmission company is also engaged in the construction of several laterals from the main line, the largest of the present construction being a 70-mile, 16-inch lateral running north to Peoria, Ill. Station construction on the system is about complete.

Indicates completed portion of line.
Indicates proposed route of line.

COLUMBIA GAS & ELECTRIC CO.

Over in the eastern territory the Columbia Gas and Electric Co. is building a 350-mile combination coupled and welded line. It extends from eastern Kentucky to Rockville, Md., where the line ties into a 20-inch system, built last year, running south from a Pennsylvania main.

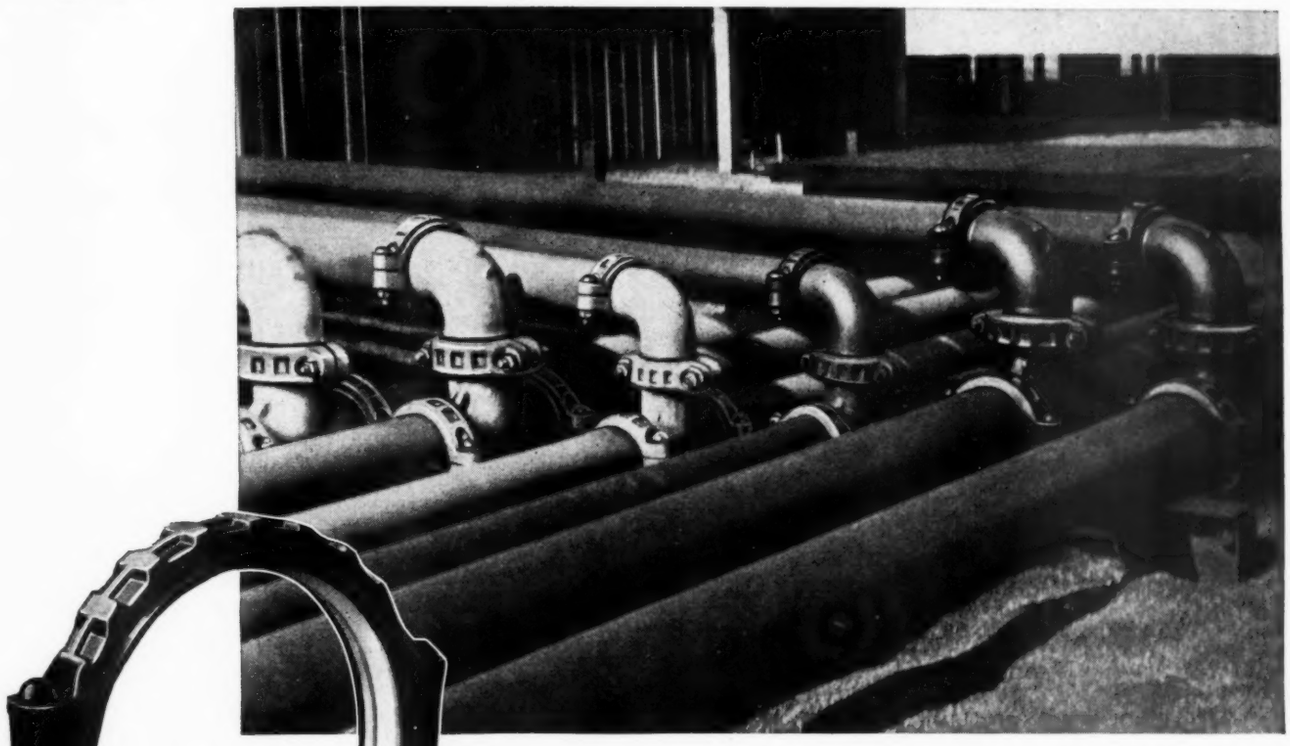
This work is divided in two sections. The west section, because of the mountainous country, will be the most difficult to construct. The section through most of Virginia will be comparatively easier construction.

SUSQUEHANNA PIPE LINE CO.

Susquehanna Pipe Line Co. and other Sun Oil Co. transporting subsidiaries have completed construction work on the western part of their system and the north section is nearing completion.

Indicates completed portion of line.
Indicates proposed route of line.

"For every joint on the line"



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The New Era in Pipe Fitting . . with Victaulic Couplings

A Victaulic Coupled installation on the yard lines of a prominent operator's bulk distribution terminal.

A Victaulic Pipe Fitting can be swiveled in the coupling and set at any desired position. The combination of the ELL and TEE in this installation permits movement in three directions to line up the final connection—saving the tedious exactitude of pipe fitting with any type rigid connection.

In addition the installation is 100% salvageable.

Victaulic Couplings are available in all sizes from ¾" up for vacuun and pressure—for steel, wrought-iron and cast-iron pipe. Mail coupon below for descriptive bulletin.

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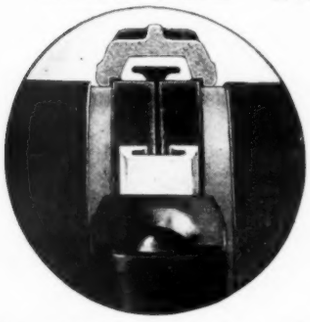

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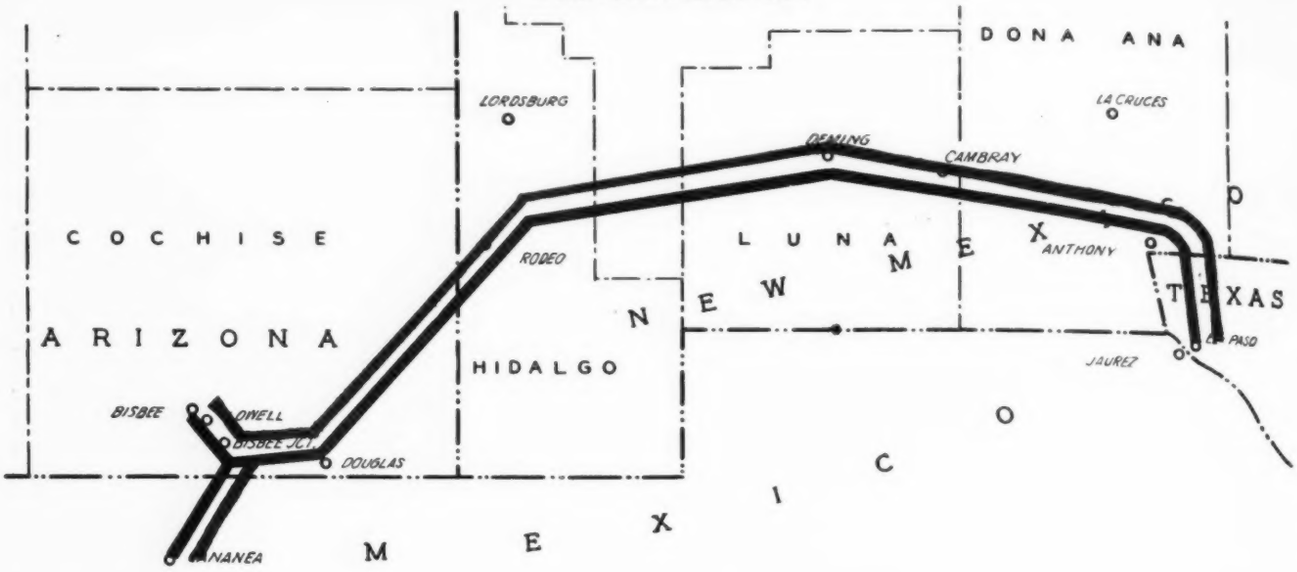
WESTERN GAS CO.



Winding up construction work with a sustained burst of speed, the Western Gas Co., El Paso, Texas, completed its 12-inch welded gas line from El Paso to Bisbee, Ariz., and Cananea, Mexico, 60 days ahead of schedule. This $6,000,000 project was built primarily to supply industrial loads at copper smelters near the terminal. The line, including the branches, will total 294 miles, and 220 miles of 12-inch was laid to supply gas to Bisbee and Cananea.

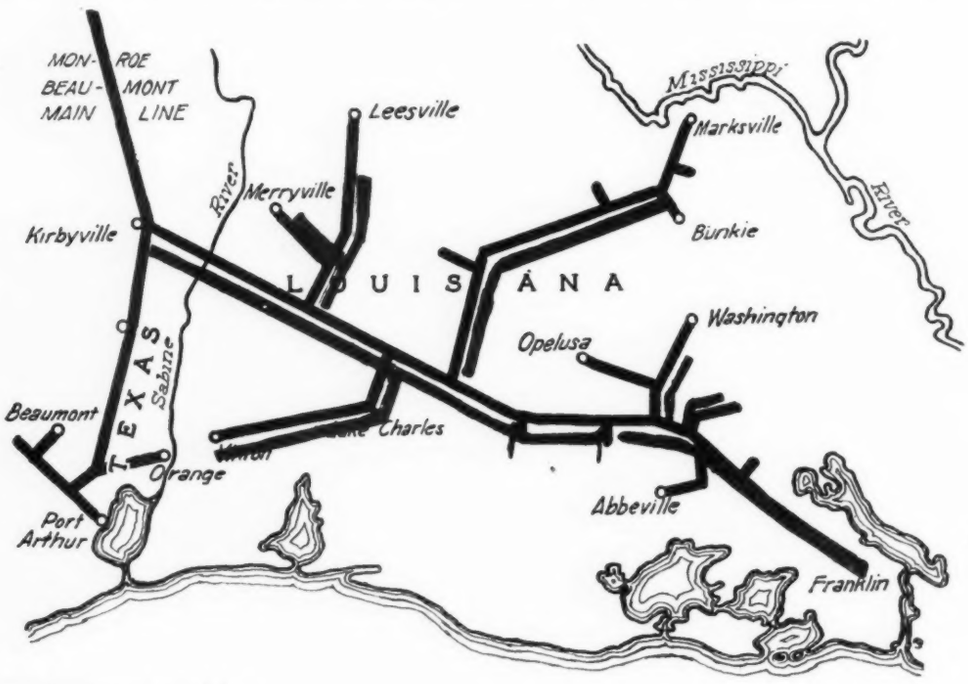
Stone and Webster Engineering Corp. and Ford Bacon and Davis, Inc., supervised construction. Bechtel & Kaiser, Ltd., California contractors, had the general contract for laying the line, and the A. O. Smith Corp. did the welding.

UNITED GAS CORP.

United Gas Corp., Houston, Texas, is rapidly nearing completion on its 420-mile gas transmission system from a main line in South Texas through Louisiana, most of which traversed heavy timber and swamp country. The line is complete from Kirbyville, Texas, to Franklin, La., except for a few bayou crossings covering a total distance of approximately 9,000 feet.

Most of the lateral work has been completed and the gas company is nearing completion on all of its distribution systems except two. The main line work was done by the F. C. Youmans Co. and the Sexton Corp., under the supervision of the Texas Construction Co., United subsidiary.

The gas booster stations have been completed except for a small amount of clean-up work. Gas was turned into the line running to Douglas early this month and the system will be in full operation within a short time.



Indicates completed portion of line.
Indicates proposed route of line.

The Month's Activities *in* Refining*

By F. R. STALEY

REFINERIES in the eastern and central divisions increased crude runs over the previous month. The western division showed a slight decrease.

The Cincinnati refinery of the Gulf Refining Company started operations the first of June. The plant has a capacity of 12,000 barrels daily. Oklahoma Crude is delivered to it by pipe line.

The first of three rerun Badger distillation units was completed at the Sinclair refinery near Houston.

The Kendall Refining Company awarded a contract to the Alco Products, Inc., for a distillation unit for its Bradford, Pennsylvania, refinery. It will have a capacity of 75,000 barrels per month.

The Independent Refining Company will erect a 1,000-barrel refinery at Mineola, Texas. L. F. Boone began operating his 200-barrel skimming plant near Arp, Texas.

The Houston Oil Company will spend $1,000,000 to enlarge its Corpus Christi refinery.

E. W. Montray will erect a 1,000-barrel skimming plant at Hawley, Texas.

The White Eagle refinery at Augusta, Kansas, will be supplied with crude from the Canton district in McPherson County as soon as its seventy-mile pipe line is completed.

The Estado Petroleum Corp., Ltd., is now operating its refinery at Long Beach, Calif. The plant has a 5,000-barrel capacity.

The Sun Oil Company has purchased the storage plant of the Provincial Oil, Ltd., in Nova Scotia, and will build a refinery at Sydney River.

Most refiners are now manufacturing a third grade of gasoline to combat the bootleggers of distress gasoline. These low grade motor fuels are used by consumers who buy on price only. They are usually colored green, purple, blue, etc.

The various plants of the Empire Oil & Refining Company show remarkable safety records. Curt Bailey, superintendent of the Gainesville refinery, operated a total of 95,000 man hours in four months without a lost-time accident. The Okmulgee and the Ponca City refineries each showed but one lost-time accident. Four gasoline plants showed no accidents since January.

Recent tests conducted at the Indianapolis speedway by the contest board of the American Automobile Association, acting for the Standard Oil Co. (Ind.), disclosed some very interesting information on oil consumption and carbon formation at high speeds. Various grades of lubricating oils were tested.

The Thirty-Fourth Annual Meeting of the A. S. T. M. will be held at the Stevens, Chicago, June 22-26. Visitors will have an opportunity to inspect the exhibit of testing apparatus and machines. Many pieces of special design and use, not produced commercially, will be displayed.

The Sinclair Refining Company will spend several million dollars to modernize the old Pierce refinery in Fort Worth, Texas.

Natural Gasoline

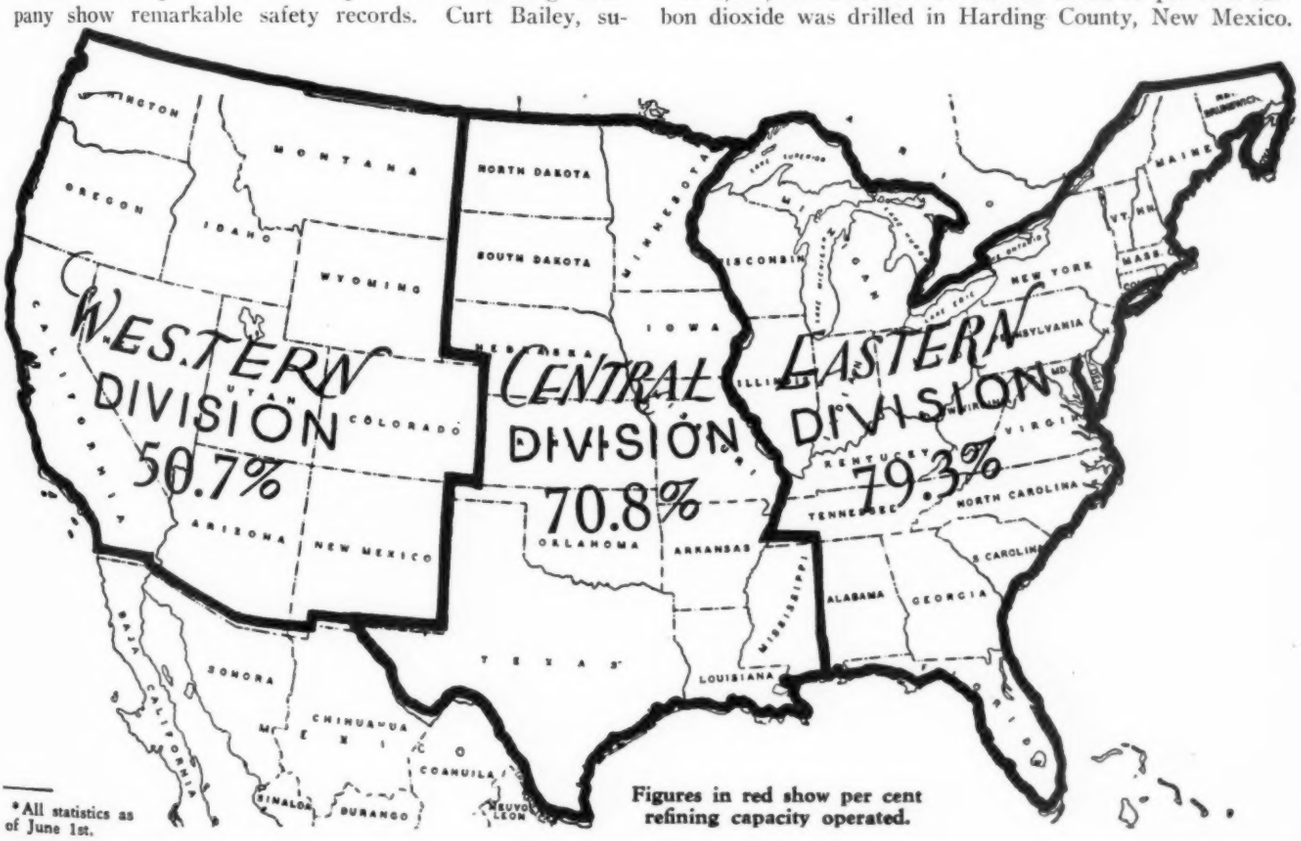
The Tenth Annual Convention of the Natural Gasoline Association of America at Tulsa was the outstanding event of last month. Many interesting technical papers were presented. Technical and economic problems of the industry were discussed.

N. C. Wells of the Texas Company presented a paper on gasoline plant operation before the California Natural Gasoline Association at the monthly meeting in Los Angeles.

The Union Oil Company of California will manufacture and market liquefied petroleum gas.

Six 200-horsepower compressors were installed to handle vapors from the storage tanks by the Kettleman North Dome Association. The recovered gas will be delivered to the gasoline plants.

A 3,650,000 cubic feet well which tested 98 per cent carbon dioxide was drilled in Harding County, New Mexico.

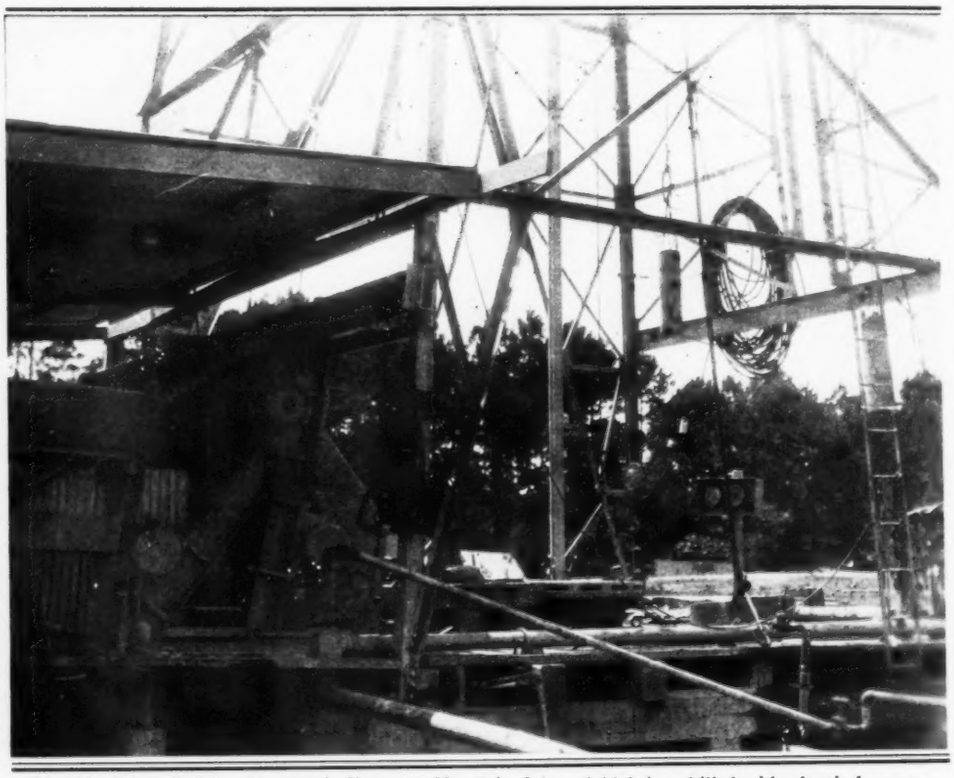


Figures in red show per cent refining capacity operated.

*All statistics as of June 1st.

DEVELOPMENT and COMPLETION METHODS *in* EAST TEXAS . . . .

SERIOUS difficulties in drilling and completing wells have, thus far, been conspicuous by their absence in the development of the new but already well-known Rusk-Gregg County field in East Texas. Seldom is a field discovered of such extent and so prolific that has fewer obstacles with which the producer has to contend in bringing in his wells. Wells are drilled and placed on production with ease and dispatch, and it is this very fact that has made the field a threat to the whole economic structure of the oil industry. What the field lacks in spectacularly performing individual wells it makes up for in its enormous extent and the consistency with which good producers continue to be brought in. These conditions have had an effect on the drilling methods and type of equipment used in the field. Save for the use of the rotary, there is a great diversity in types of drilling equipment and in the completion methods in use.



Humble Oil & Refining Company's Kangergo No. 7 in Joiner field being drilled with electrical power.

What is set down here is the result of observations made in a hurried survey of the field and covers somewhat briefly the general drilling and completion practices followed by the more experienced operators in the field.

Wells are started with a 13¾-inch hole and carried to 150 to 200 feet, where 10-inch casing is set and cemented with 75 to 125 sacks of cement. The hole is then reduced to 9⅞-inch and carried down to the top of the sand, about 3,600 feet, at which point a string of 7-inch is set and cemented with 300 to 350 sacks cement. After allowing the cement to set for 72 hours, the cement plug is drilled and the sand penetrated with a 6¼-inch hole. Penetration, on an average throughout the field, is from 50 to 100 feet.

If the well is in a new area where the thickness and top of the sand is in doubt, cores are taken. Some companies are making a practice of coring almost every well in order to determine the net thickness of producing sand penetrated, using a 6¼-inch core bit which they make do double duty.

When the amount of penetration has been decided on and the well drilled to the desired depth, several joints of screen pipe or perforated liner is set the full length of the pay sand. Usually two or more joints of screen or perforated pipe are used with one or more joints of blank pipe so as to bring the top of the liner well up inside the 7-inch casing.

After breaking down the drill pipe a string of 2½-inch tubing is run to within five or eight feet off bottom. If the well has a good volume of gas it is washed in, first with clear water, then with oil through the casing. Some operators close the well in between the casing and tubing, then swab through the tubing. After a pressure has been built up between the tubing and the casing, the latter is opened and the well allowed to clean itself. It is claimed that this latter described method reduces the danger of mudding the face of the sand.

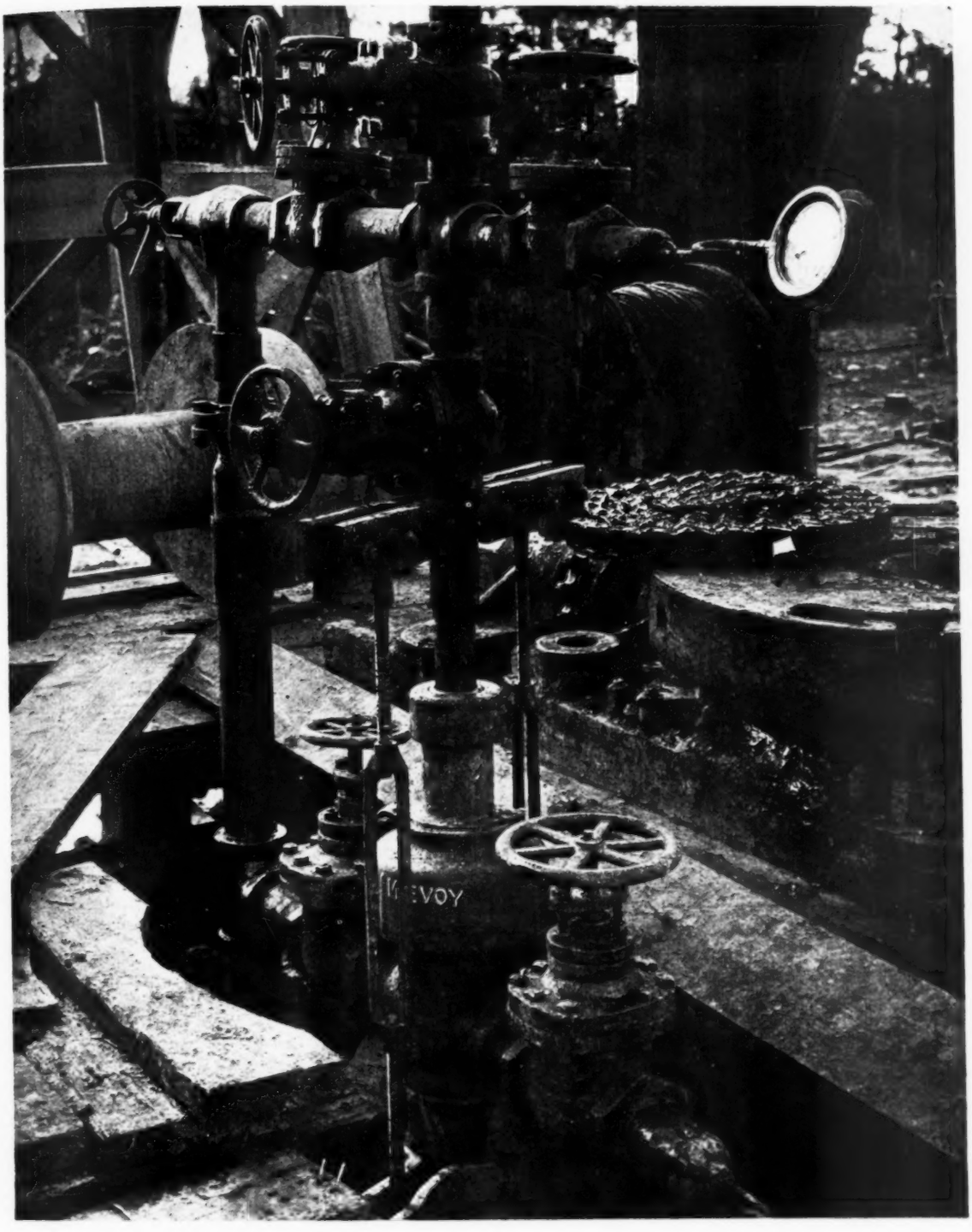
There has been little difficulty experienced with drilling mud, probably due to the relatively small volume of gas in the oil which has reduced the possibility of the mud becoming "gas-cut".

The major part of the drilling is done with fish-tail, disc, and other drag-type bits. Rock bits are used to a limited extent, usually to penetrate hard shells.

The two sizes of drill pipe in most general use are 4-inch and 5-inch. Usually two joints of 6-inch are carried on the lower end above the bit.

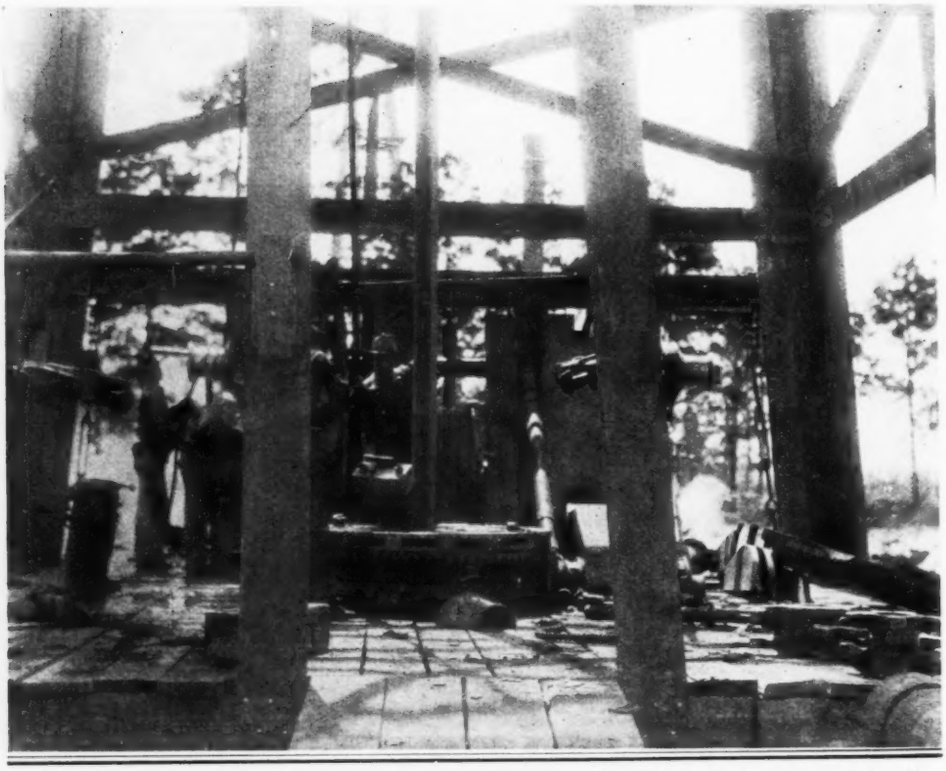
Both wooden and steel derricks are in general use, the 94-foot size being the most widely used. There are also a number of 122-foot steel derricks in use. Many of the derricks are set on concrete foundations with a 5-foot by 5-foot by 6-foot cellar.

Most of the experienced operators in the field have a clause in their drilling contracts limiting the amount of



THIS IS A PHOTOGRAPH OF A McEVOY UNIVERSAL CASING CONTROL HEAD INSTALLATION IN THE EAST TEXAS FIELD. WHEN USED WITH A McEVOY AUTOMATIC SAFETY PRESSURE HEAD, IT AFFORDS COMPLETE PROTECTION WHILE DRILLING AND WHILE RUNNING TUBING. IT DOES NOT HAVE TO BE REMOVED FROM THE WELL AND IS THEREFORE THE IDEAL FOUNDATION FOR CHRISTMAS TREE. WHEN SO MUCH IS AT STAKE, IT DOES NOT PAY TO USE CASING HEAD EQUIPMENT THAT IS IN THE EXPERIMENTAL STAGE. IT DOES PAY TO USE THE McEVOY UNIVERSAL THAT IS PROVEN AND KNOWN TO BE SAFE.

When writing J. H. McEvoy & Co., *please mention The Petroleum Engineer*



Typical drilling well in the Joiner area. They are about ready to land the 10-inch casing on this well.

deviation of the hole from the vertical. As far as can be ascertained these operators are having no difficulty keeping their wells straight to within one or two degrees and the deviation seldom exceeds three degrees. Weight indicators are in general use. It is reported, however, that many wells have been, and are being drilled without regard to their deviation from the vertical, especially by inexperienced operators in the field, and that surveys made on some of these have shown them to be excessively off vertical.

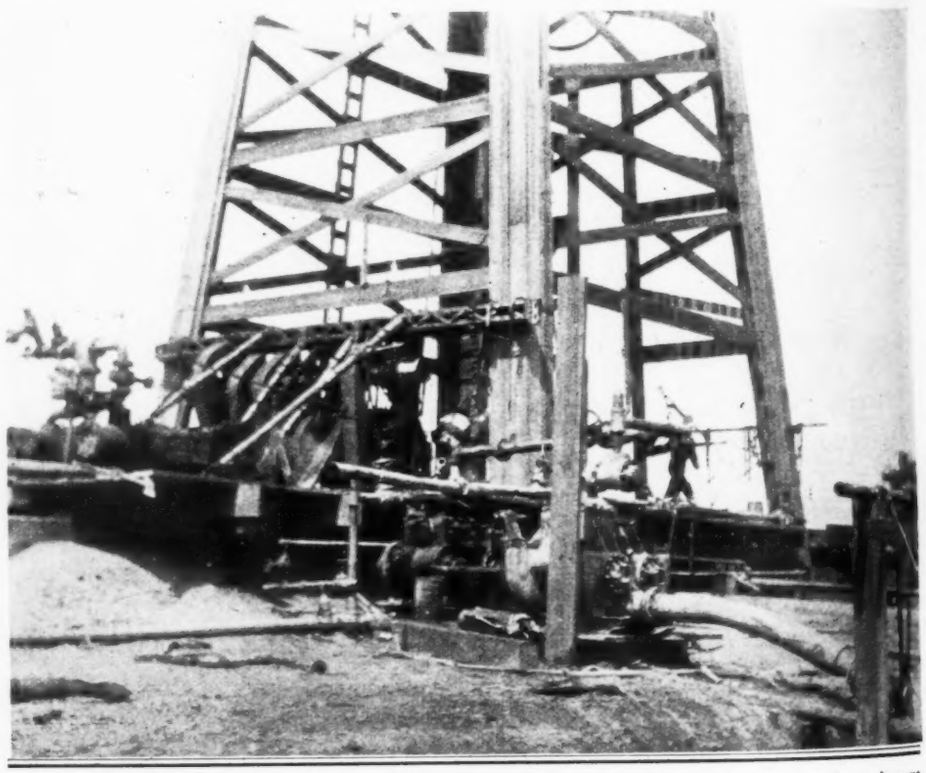
Ease of drilling is reflected in the high drilling speeds that characterize the development operations in this field. Wells have been drilled in 78 hours net drilling time. This is a rate of about 46 feet an hour. It takes less time to drill the well than it does to rig up to drill.

The cost of drilling and completing a flowing well in this field is variously estimated at from $17,000 to $20,000.

It is estimated that there are about 500 rotary drilling outfits in the field, each of which is capable of completing a well a month. This includes rigging up, dismantling and moving to another location.

At this writing (June 1) there are 508 wells drilling in the field, and 96 locations with derricks on them ready to drill. Of the 508 wells drilling, 162 are in the Joiner area, 249 in the Kilgore or Bateman area, and 97 in the Lathrop area at the north end of the field. Of the 96 locations staked and ready to drill, 26 are in the Joiner area, 38 in the Kilgore or Bateman area, and 32 in the Lathrop area.

The extent of the productive area of the field is variously estimated at from 75,000 to 120,000 acres. Well spacing throughout the field is not uniform due to the irregular configuration of the lease boundaries, also there are comparatively few large blocks of acreage held in the field, hence with the offset requirements it is almost impossible to adopt a logical well spacing program under the competitive conditions existing. Assuming an average spacing of 10 acres per well for the field, which is probably a much closer spacing than is economically justified, some 7,500 to 12,000 wells will be drilled within the productive limits of the field. Already 735 wells are producing and 508 are drilling, giving a total of 1,343 wells, which it is estimated will be completed by early July, 1931. To this remarkable rate of development much can be ascribed to the ease of drilling and completing wells in this field.



Drilling well in the Kilgore area, mud pumps in the foreground. No housing is placed over this equipment.

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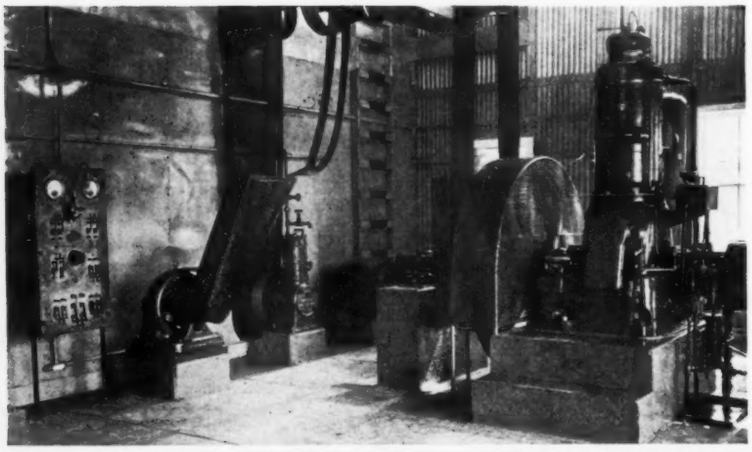


Auxiliary equipment.

STANOLIND *Has* Model Station *at*

SELDOM are field oil line stations on a parity with a main line station in maintenance costs or appearance. In the great majority of instances they are temporary installations at best, equipped with old machinery housed in a hurriedly-constructed building to meet a peak load and thereafter care for a declining load. Due to these conditions, operating costs are generally higher, maintenance comparatively more costly and appearances usually as discouraging as operation costs.

F. M. Darnell, chief engineer, Stanolind Pipe Line Co.'s Wewoka station, has gone to considerable lengths to overcome these objections to his station. Consequently, he has a field station attractive in appearance and one reflecting good care in low maintenance charges.

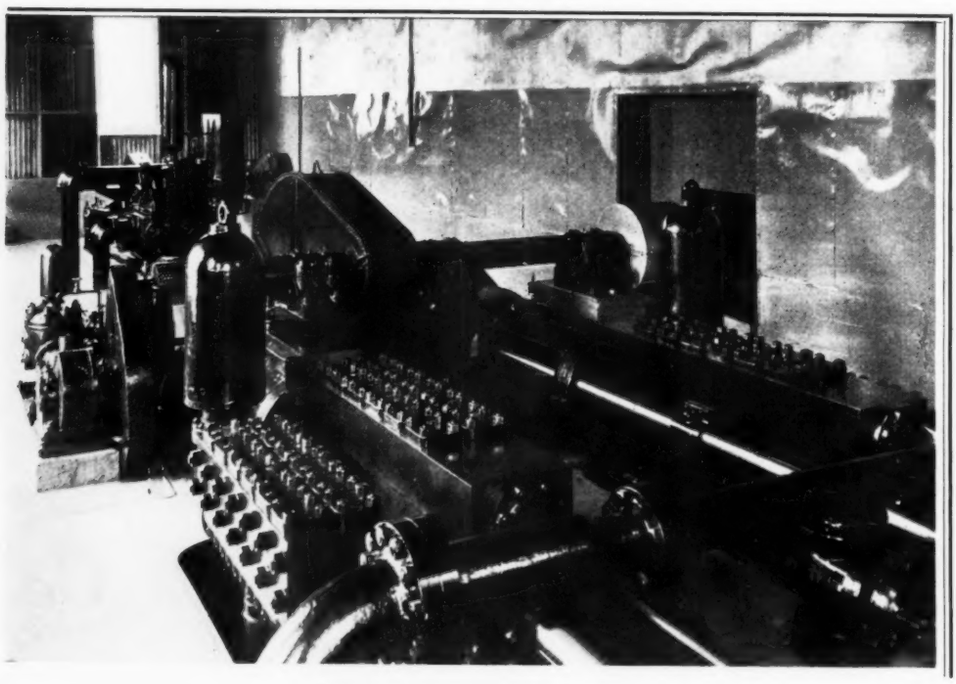
The station was built about eight years ago and has pumped about 33,000,000 barrels of oil during that time. Its main unit consists of a four-cylinder, 260-horsepower at 277 r. p. m. solid injection Diesel engine driving a 5½ by 24-inch reciprocating pump.

When the station was first erected Darnell started landscaping the grounds with bulbs and cuttings of various flowers which he possessed. Since that time he has continually added to the flower beds. One section of the site is ideally adaptable for conversion into a playground and with little cost the employes in the district have a picnic ground and playground for their families.

Otherwise junk material found further service in being utilized for fencing and building guards about the station and grounds. Old pipe was used for fence posts, and to make the fence more attractive curved angle irons of old tanks were used to form the top part of the fence. The remainder was made by stringing discarded wire rope.

The grass covering the grounds is always close-cut and the chat road around the grounds is in good repair the year around. To add further to the attractiveness of the immediate station grounds a large fish pool has been built during spare moments.

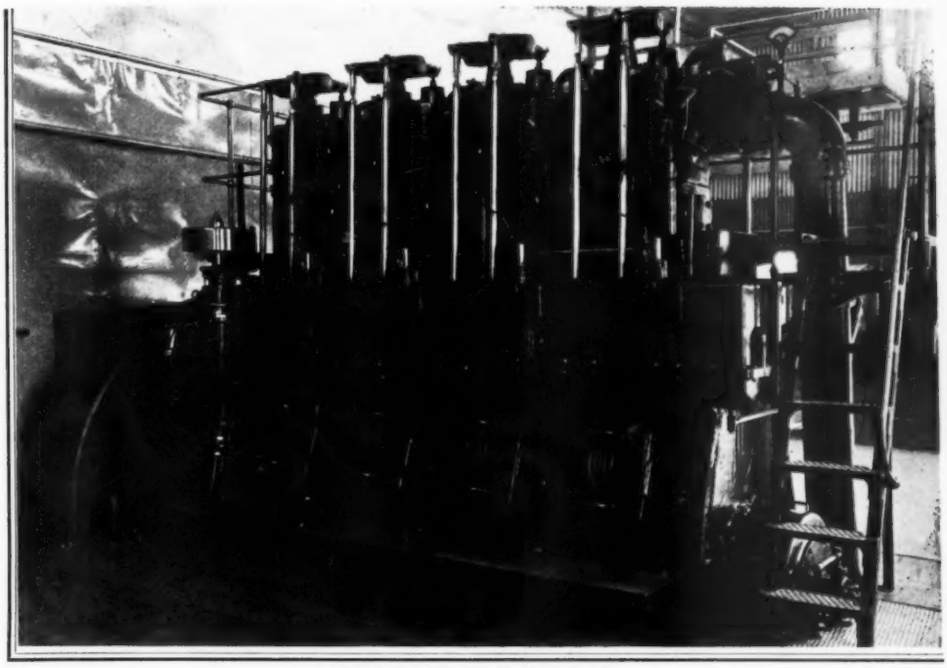
With all of this work being done during spare time and at a minimum cost it only follows that the interior of the station should reflect the same care and attention. All of the machinery was thoroughly cleaned and put in a state of good repair before going into service. Since then the machinery is cleaned daily and a close check made to observe possible trouble before it develops into something serious. This attention to the engine shows itself in the record of liner wear, which has been .040 during 40,000 hours. The year 1929 is representative of the "down" time of the station. It was operated 8,542 hours, pumping more than 6,000,000 barrels, and was down only 134 hours, much of this time for inspection. The first ring change was made in 1928. Performance of the pump was equally as satisfactory.



Main line pump and suction pump.

A 37½-horsepower 300

Pipe Line Gathering Wewoka



260-horsepower main line engine.

r. p. m. vertical oil engine is the prime mover for the auxiliary equipment. It drives all of the equipment with an overhead line shaft by belt drive. One belt is connected to the pulley on the small generator to supply lights for the station and cottages. Another drives the vertical air compressor, which maintains starting air pressure in the four air tanks located inside of the building.

Shaft pulleys for these two auxiliaries are located on the engine room side of the station and one may be used to drive the emergency circulating pump located opposite the compressor. The shaft pulley for the 10 by 18 suction pump is located on the other side of the fire wall. The water circulating pump is attached to the main line pump. It picks up water from the hot well and discharges it in the two overhead wooden tanks.

All of the moving parts in the station, such as belts and flywheels, are guarded with hoods made either with solid sheet metal or perforated sheet metal. Safety in the station is further promoted with bulletins and periodical safety meetings.

In addition to the fire-fighting facilities afforded by the water lines, the station has a portable foam tank and numerous hand extinguishers. The latter are stored in cabinets located at a convenient height on the wall. On the door of each cabinet is a card holder on which is typewritten the date of the last charging of the extinguisher, and testing date.

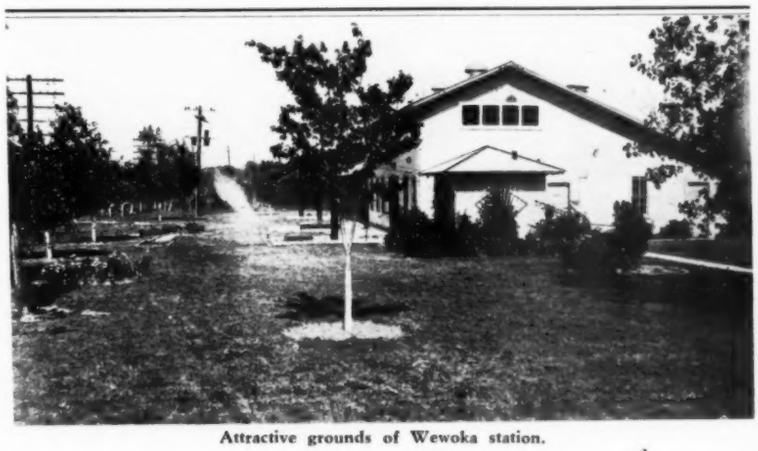
One of the principal reasons for the low maintenance charges for the station may be in the attention given to lubrication problems. All of the oil is filtered and gravitates to the engine from an overhead tank. A close watch is kept on the condition of the oil, which is changed when found to be unsatisfactory.

Numerous devices to improve local conditions also play an important part in the station's operation. To insure a closer check of lubrication on the coupling between the engine and the pump a special covering was made. The top half has a trough across the front and an outlet pipe leading outside. This permits the oil stream to flow into a cup on a nipple attached to the bottom half of the covering and from this the operator may observe whether the coupling is getting proper lubrication. The cover has plugs in the top and bottom for filling and draining.

To do away with the mess attached to sampling oil a special device has been built on the suction unit. It consists of three short lengths of small-diameter pipe attached to a boiler plate frame. A line connects one of these with the pump and the other two are used as receptacles for the hydrometers. When a test is desired the center receptacle is filled with oil and the gravity test made. A hand-operated centrifuge is also attached to the frame and a shake-out test made with it. The oil is then permitted to drain into the sump.

The station warehouse, containing small parts for the station and line construction and repair equipment and parts, is also kept in a neat and orderly condition, not only aiding in finding material when needed but tending to speed inventories.

The station buildings and floors are kept neatly painted and the floors free of oil spots.



Attractive grounds of Wewoka station.

Rack for storage of waste oil unit.

Loading waste oil unit on truck.

Special Bodies Built for Pipe Line Trucks

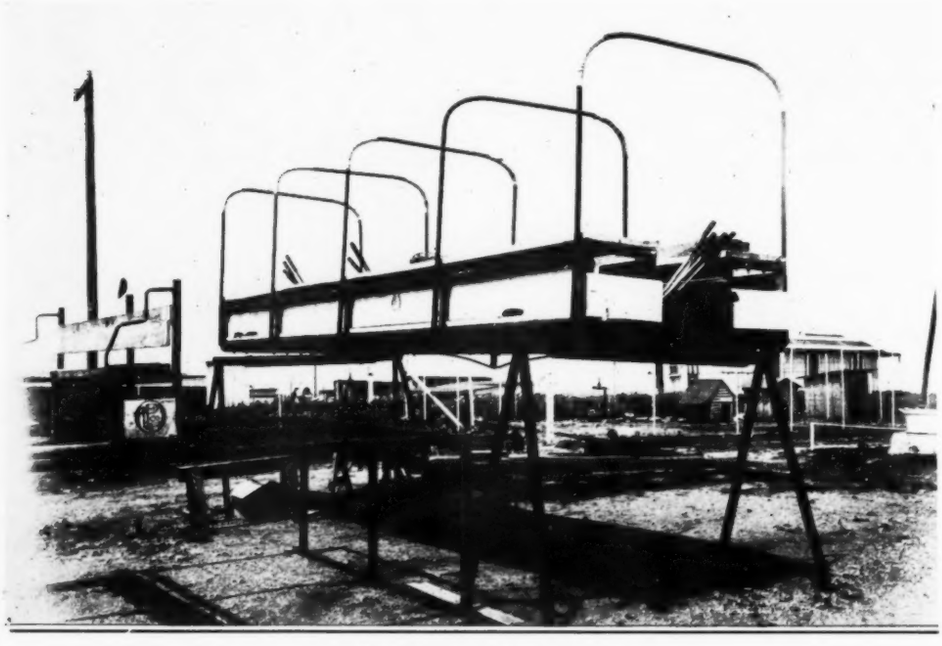
WHEN safety measures decreed pipe line construction or repair crews should be transported to and from work in special truck beds to keep workmen from riding with their legs dangling over the sides, various types of auxiliary truck equipment was designed. For the most part they all were designed to accommodate a crew and carry tools. When the larger sizes were built it entailed no small problem of loading and unloading the beds on trucks and trailers and storing them.

The Oklahoma Pipe Line Co. had requirements for a large truck bed to transport both men and tools during a recent boom. The smaller beds which could be lifted on a truck and boomed to it required too many trucks and was generally unsatisfactory. Therefore, when a bed 24 by 5½ feet was built provisions had to be made to facilitate loading and unloading it on a truck and trailer as well as storing it when not in service.

H. L. Hickman, district foreman, built an "A" frame rack which readily solved the problem. With it loading the bed on the truck and trailer was a comparatively easy task accomplished in a few minutes. Unloading on the frame was equally as quick.

The uprights of the frame were made with 2-inch pipe welded to a 3-inch cross piece. The cross piece was cut in two with a torch and a 4-inch piece of pipe used as a roller, was slipped over the 3-inch when the frame was pulled apart.

To load the bed on a truck and trailer, the truck is backed to the frame which is higher than the truck bed. The tailer is backed on beneath the bed. The front end of the frame is tilted, permitting the bed to slide downward easily to the truck. When it is securely fastened to the truck the truck is moved forward, pulling the rear frame from beneath the bed and allowing it to slide to the trailer. After the bed has been boomed to the truck and trailer it is ready for service.



"A" frame truck bed rack.

Unloading it is as simple. Both frames are tilted toward the truck and trailer as it is backed into position. As the truck moves back the frames are pushed into an upright position, lifting the bed off the truck and trailer.

The same principle was used for the storage of waste oil units which are mounted on skids. When these are loaded on trucks they are usually difficult to manage and tilt the front end of the truck upward. To overcome this a roller rack was made and set in concrete.

Corner posts were made with 4-inch pipe welded to top and bottom beams. Three-inch pipe was used for cross pieces. Four-inch pipe was slipped over these before the cross pieces were welded to the top beam and served as rollers. The bottom beams were set in concrete.

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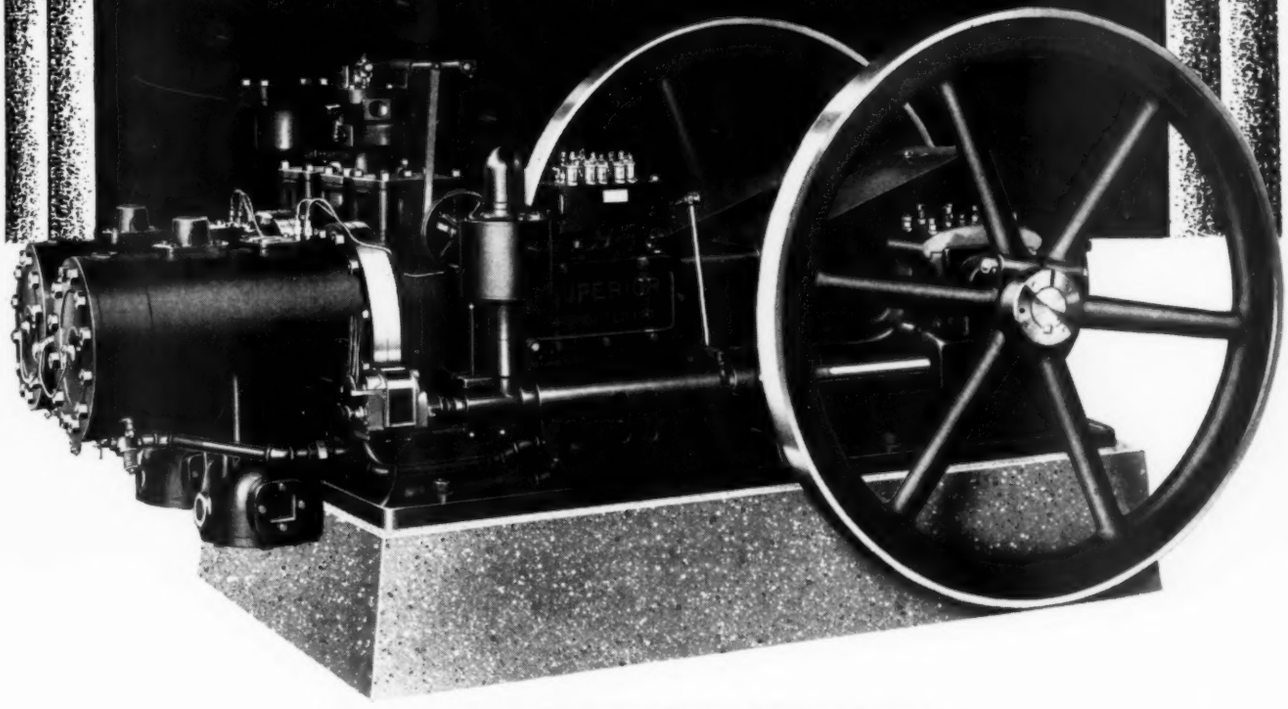

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Ohio Test Drilled with

Diesel Powered Standard Rig

EXCELLENT drilling time was made by a Diesel engined powered standard tool rig, which recently completed a test in Stark County, Ohio. The well was finished at a depth of 4,461 feet in 54 days' drilling time. The first 4,300 feet were drilled in 42 days, or on an average of better than 100 feet per day. Drilling the remaining portion of the hole was much slower because of penetrating a very hard lime formation and the use of small tools in the five-inch hole.

In addition to excellent drilling time, the well was drilled at a low fuel cost of $3.00 per 24 hours. Forty gallons of 36 gravity A. P. I. crude oil, costing 7½ cents per gallon delivered at the well, was consumed each 24 hours. A total of 2,160 gallons of fuel oil was used in finishing the well. The lubricating oil consumption averaged less than one gallon per 24 hours. This included an oil change made every 10 days. Only a few gallons of water were added to the large, heavy, sectional-type radiator.

Drilling with Diesel engine power, while not exactly new, has recently received additional impetus through the manufacture of lighter units that can be moved from place to place with practically no lost time. Two teams in one day's time can move the motor a number of miles and two men in two hours' time can set the engine up. To aid mobility, the unit used on the Stark County well was self-contained on a rugged structural steel welded frame that required only a light, inexpensive foundation.

The power plant of the drilling engine was 6½ by 8¾, 4-cylinder, 4-cycle type, having a 120-horsepower rating at 1,000 revolutions per minute. The transmission was of two-speed design, having the power take-off pulley shaft on the left hand side at right angles to the center line of the engine. The motor construction was such that it could be operated on either two or four cylinders, permitting two cylinders to be put out when the maximum engine power was not needed to operate the rig.

The power from the motor to the belt pulley was transmitted by means of noiseless spiral bevel pinions and large diameter bevel ring gear with the shafts running in an oil bath; all enclosed dust-proof transmission case.

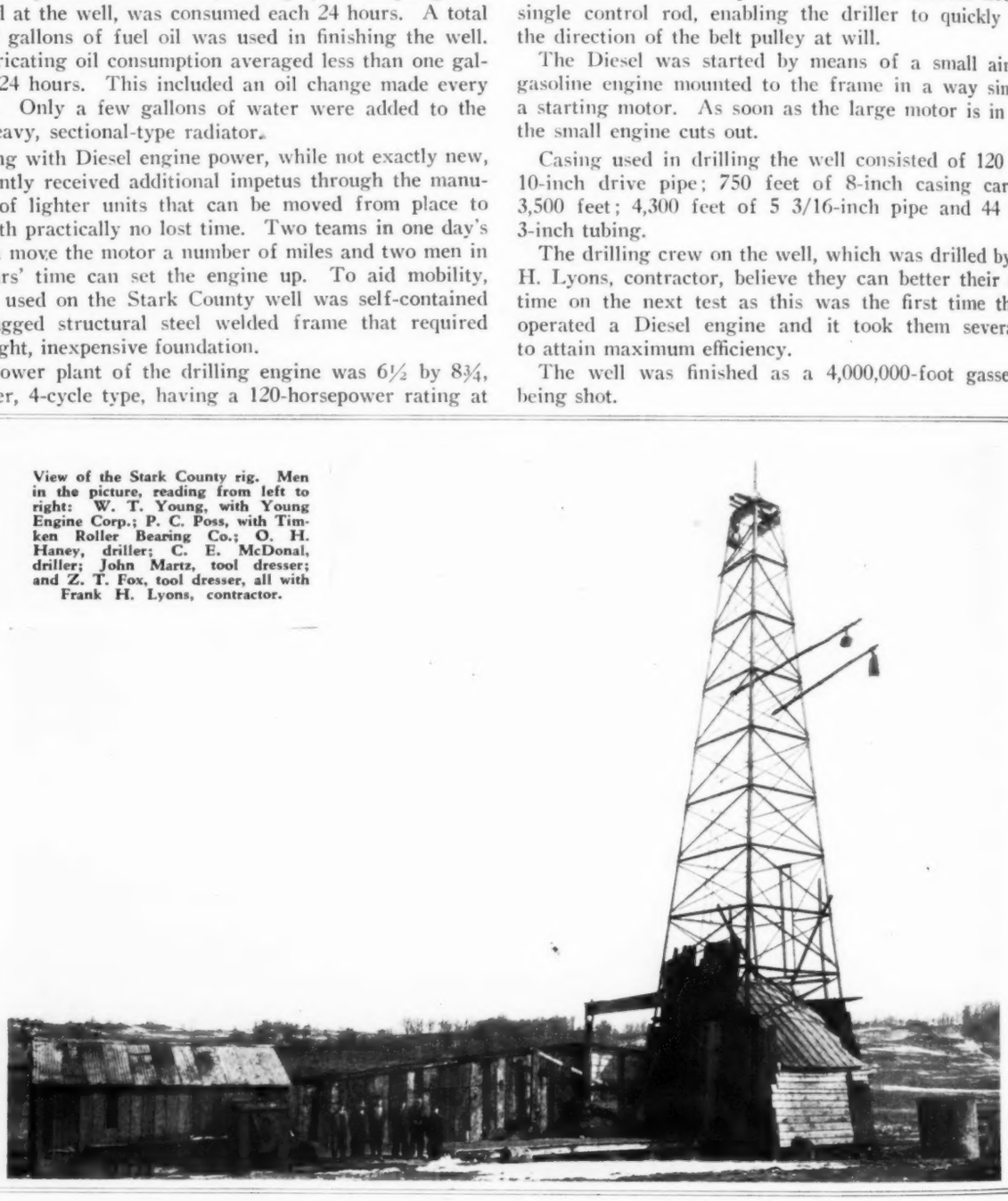
The clutches were operated from the derrick floor by a single control rod, enabling the driller to quickly change the direction of the belt pulley at will.

The Diesel was started by means of a small air-cooled gasoline engine mounted to the frame in a way similar to a starting motor. As soon as the large motor is in motion the small engine cuts out.

Casing used in drilling the well consisted of 120 feet of 10-inch drive pipe; 750 feet of 8-inch casing carried to 3,500 feet; 4,300 feet of 5 3/16-inch pipe and 44 feet of 3-inch tubing.

The drilling crew on the well, which was drilled by Frank H. Lyons, contractor, believe they can better their drilling time on the next test as this was the first time they had operated a Diesel engine and it took them several days to attain maximum efficiency.

The well was finished as a 4,000,000-foot gasser after being shot.



View of the Stark County rig. Men in the picture, reading from left to right: W. T. Young, with Young Engine Corp.; P. C. Poss, with Timken Roller Bearing Co.; O. H. Haney, driller; C. E. McDonal, driller; John Martz, tool dresser; and Z. T. Fox, tool dresser, all with Frank H. Lyons, contractor.

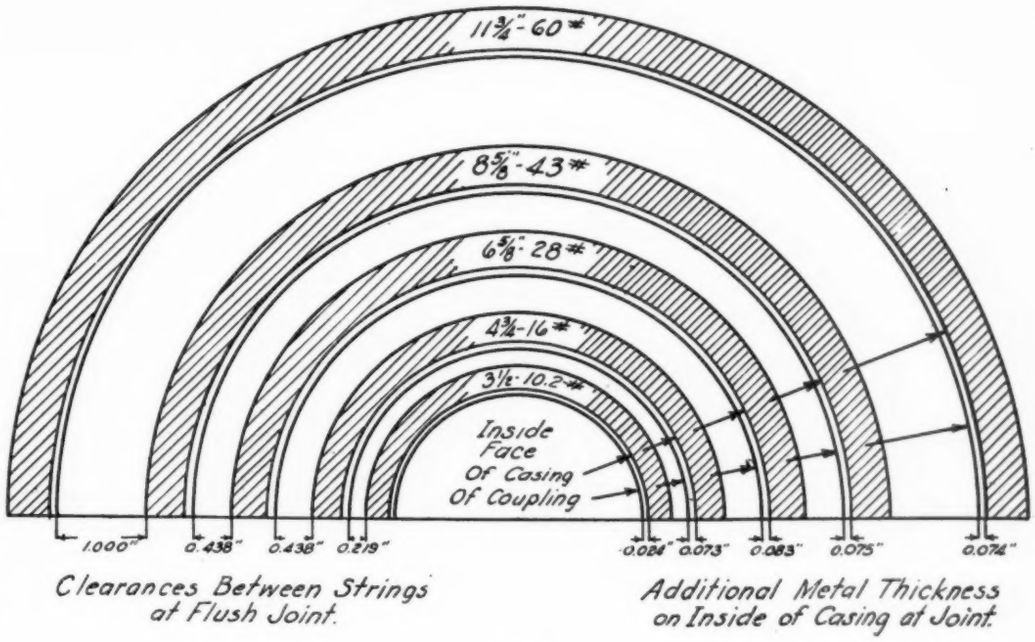


Fig. 2

Use of Flush Joint Casing for Long Strings

CASING programs demand considerable attention in the development of any field, and they are of particular importance when the drilling is as hazardous as that in the Kettleman Hills, California. Clearances between strings and between the casing and the walls of the hole must be assured; yet due consideration must be made of the size of the hole, which should be kept to the minimum without endangering the final completion of the well. With all factors being given due regard, the Petroleum Securities Company is effecting economies in drilling its well, Felix No. 2, in the W½ of the E½ of Section 35-21S-17E, on the North Dome of Kettleman Hills, by the use of flush joint casing.

The interest in the North Dome of the Kettleman Hills field was actively revived with the completion of Superior Oil Company's well, Huffman No. 1. The well was drilled to a total depth of 8,323 feet. Indications are that many more wells will go below the 8,000-foot depth in this area, since the Huffman location is on the north plunge of the north dome and had an initial production of 6,000 barrels of oil per day. With similar deep holes an immediate prospect in the Kettleman Hills field and with an assurance of continued deeper drilling throughout the country, the use of flush joint casing for long strings will probably be given greater consideration than it has in the past.

The greater the diameter of the hole being drilled, the greater will be the amount of material that must be taken out. When this amount of material can be lessened there will be an accompanying saving in steel worn off in the bits, a decrease in wear and tear on equipment, and an increased speed in reaching greater depths. These are all factors that make a hole of the smallest possible diameter desirable; but the necessary casing program for a well presents other factors that limit the size of a hole definitely and conclusively. The use of flush joint casing for the longer strings was felt by the Petroleum Securities Company to offer a means of reducing the size of hole that had to be made and at the same time insure less trouble in running pipe to the great depths being drilled. The flush joint casing program was therefore planned. It started with the 11¾-inch string and included all casing from that size down. The decision to use such a program naturally influenced the size of hole from the surface and permitted a 16-inch string of 63½ pounds seamless to be run to 1,470 feet. From this point a 14¾-inch hole was drilled to 5,644 feet and the first string of flush joint casing was then run in.

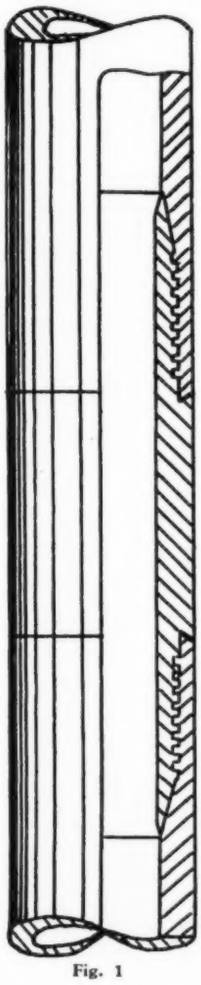


Fig. 1

The flush joint being used is of the type illustrated in Fig. 1. It consists of a double pin coupling with square threads made to close tolerance on both ends. An annular inward beveled shoulder mates with a corresponding bevel in the casing. The square thread eliminates the tendency of the joint to climb the thread, as is characteristic of the V-thread type; it therefore develops a strength equal to the ultimate strength of the metal at the root of the thread. The taper seats on the inside make the joint fluid-tight when it is made up solid and, besides providing an exact draw at the top, pull the threads into closer contact. The arrangement supports the pipe at the inner end of the thread and prevents the bending which tends to destroy the inserted type of pipe.

The string of 11¾-inch, 60-pound flush joint casing was run to 1,600 feet with latch elevators and from that point to 5,644 feet with slip elevators. Although the company was confident that the entire length could be handled safely with plugs and the latch elevator, no chances were taken and the slip type of elevator was used for the greater depths. The string consisted of 153 joints, which were spun on with the cat-head and set with just one jerk of the

tongs. No trouble was experienced in stabbing. A Baker casing shoe and float collar were placed on the bottom and another float collar at the top of the first joint.

The time elapsing from the time the tools were started out until the casing touched bottom was approximately twenty-four hours. This elapsed time gave the mud a chance to settle to a considerable extent. No trouble was experienced, however, and the absence of collars prevented any gripping of the walls, the scraping of mud from the sides or the jamming of material on the pipe. The simplicity of the job was facilitated both by the straightness of the hole and the condition of the mud. The drilling fluid was straight Mojave mud with a little Baroid and about ten sacks of Aquagel.

Fluid was added while running the casing to keep the pipe down. No friction was evident and the weight indicator gave the same reading when the string was picked off bottom as when it was being run in. The advantage of a smooth outside surface throughout the entire length of the string was clearly shown here.

The flexibility of a flush joint program from the 11¾-inch string on down is clearly indicated in Fig. 2. Conditions such as those encountered in the Kettleman Hills field can readily be met. A water string of 8⅝-inch casing was run to the 6,800-foot depth in place of the 9-inch now being generally used. Inside of this, any size of flush joint casing from 6⅝-inch on down can be set with sufficient clearance to avoid difficulties and without the disadvantages of couplings protruding on the outside of the pipe to increase friction.

The time elapsing from the time the tools leave the bottom of the hole until a string of casing is landed at that point naturally increases with the depth of the well. This increased time allows increased settling of the mud and, when a depth as great as 8,000 feet is reached, it is hard enough to run any kind of casing. The advantages offered by flush joint casing are well worth considering, since friction is reduced to a minimum and scraping from the walls of the hole is practically eliminated. The condition of the mud at these great depths has considerable to do with the success of running any kind of casing and provision must necessarily be made to hold the solids in suspension for the longest time possible. Even the best of mud may need a colloidal material added for great depths, although it may contain a sufficient amount within its own composition for ordinary purposes. Flush joint casing will naturally have an advantage over that using collars when the solids do settle to the bottom while a string is being run; but the least amount of settling will facilitate the work and aid materially in getting the string on bottom.

The increase in speed due to a reduction in the size of the hole is a matter of considerable importance. In the well Felix No. 2, where the flush joint casing program was used, the first 5,000 feet were reached on the 35th day of elapsed time. This was considerably faster than in the same company's offset well, which used the same type of rig but employed the standard casing program. The speed with which a well can be drilled is an economic factor, whether there is a rush for production or not. The drilling cost per foot for two wells drilled to the same depths with identical conditions is going to be vastly different when one is completed in 120 days and the other in 90 days. Everything that will increase the speed, therefore, should be given due consideration and weighed with the other factors involved.

It is assumed, of course, that the straightest hole possible is alone considered; and comparisons must be made with such holes in mind. The Felix No. 2 well was a straight hole and this fact naturally facilitated the running of casing. Some holes, unfortunately, are not so straight; but the advantages of flush joint casing arising merely from its absence of collars extending beyond the outside of the casing are increased when running in a crooked hole. The smooth, unbroken surface generates the least amount of friction when going around a bend and the wall is not scraped by protruding collars.

The reduction in the inside diameter of the pipe at the flush joint is very small. This is indicated for the Kettleman Hills program in Fig. 2. Such small differences are secured by making the coupling of a much stronger material than that used in the casing. This design also permits a greater thickness to be maintained in the pipe itself.

When a string of pipe is in tension it has a lessened resistance to collapsing pressure. There have probably been many cases where collapse has occurred when a string was frozen and under great tension. Collars are naturally conducive to tight strings under many conditions, both through their direct contact with the walls of the hole and their holding and piling up of sloughed material around the pipe. The smooth outside surface furnished by flush joint casing will then naturally be somewhat influential on collapsing strength under many conditions, although such influence is indirect.

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COMPLETING *the* WORLD'S

By W. A. SAWDON

THE completion of what is now the deepest commercial producing well in the world by the Associated Oil Company in the Ventura Avenue Field, California, has focused increased attention on the drilling methods employed in this field as well as having gained attention because of the record achieved. Drilled to 8,823 feet, Lloyd No. 57 had an initial production of 5,282 barrels of 30 gravity oil.

This compares with Continental Oil Company's McGrath and Selover No. 24 in the Seal Beach Field, California, which was drilled to 9,054 feet and Big Lake Oil Company's University 3-C in the Big Lake Field, Texas, bottomed at 8,923 feet. The former, not completed at that depth, obtained oil which is believed to be coming from a zone higher up, while the latter is making less than 200 barrels per day. The greatest depth yet drilled was in Standard Oil Company's well Williams No. 1 in the Semi-Tropic Ridge district in Kern County, California, which was last reported at 9,702 feet. Lloyd No. 57, however, proves the existence of the deeper production which has been expected in the Ventura Avenue Field and is but the first of the wells which the Associated Oil Company will eventually drill to the lower zone. The entire thickness of this zone was not penetrated and production is from both the new zone and from the lower portion of that from which other deep wells in the field are producing.

The deepest commercially producing well in the world. Associated Oil Company's Lloyd No. 57, Ventura avenue field, California.

The heavy type of rotary drilling equipment now being used for the drilling of deep wells in California was employed on the well. A Haliburton automatic control was used continuously to a depth of 7,139 feet. Below that, the control was used only intermittently since considerable coring was done and manual control was desired. Three cores were taken every hundred feet down to about 8,000 feet and from there on the hole was cored practically all the way. There were three strings of casing cemented in the well. The 20-inch was set at 997 feet, the 13⅜-inch at 4,597 feet and the 9-inch water string at 7,139 feet. No trouble was experienced in running any of the casing with the water string equipped with a float plug and a float collar one joint above. A little trouble was caused by lost circulation before the 9-inch string was run and a colloidal admixture had to be introduced into the mud to overcome this. The same condition has been encountered in practically all the wells drilled in this area. The hole was kept very straight all the way, but the acid bottle was used only to a depth of 7,140 feet, since there was too much gas encountered below the 9-inch casing to warrant the risk involved in taking readings. A deviation of two degrees was recorded where the water string was landed and the maximum angle read above that point was four degrees.

A 7⅞-inch hole was drilled from the 9-inch string to the bottom and it was the intention to run another water string. Time was not available for this, however, and a 5-inch perforated liner and 3-inch tubing were set instead. A pressure of 1,350 pounds per square inch was registered on the casing, but no shut-in pressure has been taken. It is estimated that this pressure would probably reach 2,500 pounds per square inch. The gas volume is slightly above four million cubic feet per day. Although 3,000 pound fittings are being used on the well, it is doubtful if it will be shut in for any purpose at the present time. Production is

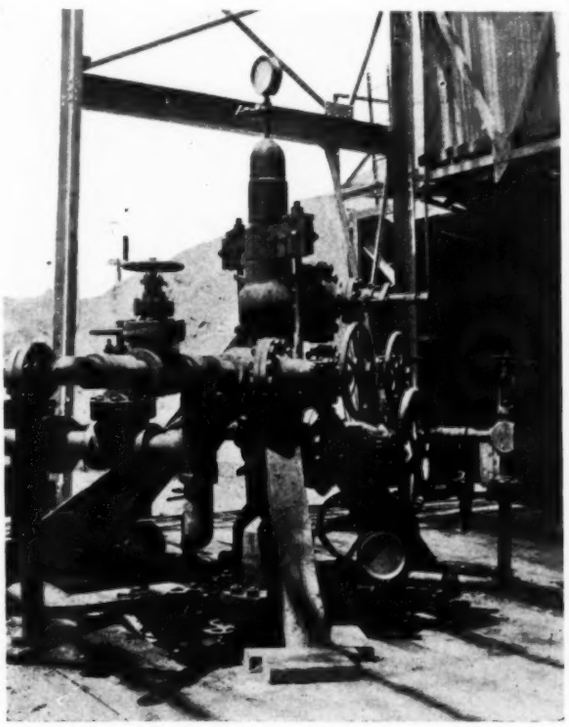
The drilling mud from the wells is carried down to the classification plant by means of these open flumes.

DEEPEST PRODUCING WELL

Petroleum Engineer, Los Angeles

being taken through 4-inch flow lines beaned to 1-14/64 inches.

The usual method employed by the Associated Oil Company in this field for supplying steam for drilling operations was used on Lloyd No. 57. A permanent battery of twelve boilers is here set to handle up to three drilling wells. The boilers can be seen in the photograph and in this case are located just below the well. The steam is piped directly from the battery to each well being supplied and when a well is completed the line is laid to some other location. Frequently, only one or two wells are being drilled from one battery; in that case only those boilers necessary are fired. This system fits in admirably with the drilling campaign of the company and provides for any deepening or big cleanout job that might arise. Moreover, the boilers can be used for any pumping operations and are sometimes used to supply necessary steam for the mud system installed in the field.



A type of well hook-up used in the Ventura avenue field.

The mud used in Lloyd No. 57 was taken from the classification plant until the 9-inch string of casing was set. From there on, new mud from a central mud plant was used exclusively. The classification plant mud which is used for general drilling on all the Associated Oil Company's leases is capable of providing a rather heavy fluid. But to do this for one well would not be economical and the average weight is kept between 72 and 75 pounds per cubic foot. The presence of gas encountered after going out of the 9-inch casing in this well made it desirable to increase the weight of the drilling mud so new mud of about 80 pounds per cubic foot was then used.

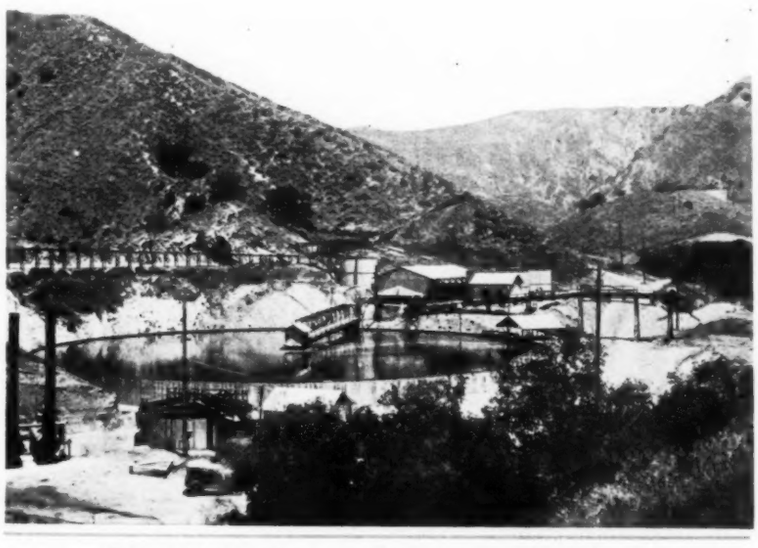
A weight material was also added to the drilling fluid during the last few days before the well was completed and the average weight of the mud was kept from 85 to 90 pounds below the 8,800-foot depth. The heaviest mud used, however, did not exceed 100 pounds per cubic foot.

The mud returns from the well went into the general mud system and flowed down an open flume. The mud from this and other wells being drilled, flows by gravity down to either one of two pits or sumps which are of considerable extent. It is pumped out of these into flumes through which it gravitates down to the classification plant, which is located near the bottom of a canon and at an elevation much below any of the wells or collecting pits. The classification plant and the flumes are shown in the accompanying illustrations.

After having the abrasive contents removed from the mud at the classification plant, it is pumped to the drilling wells for use. A supply of prepared mud is, of course, kept on hand at the classification plant and two tanks are also kept full at each drilling well. The necessary amount of drilling fluid is therefore assured at all times.

The central mud mixing plant formerly supplied mud continuously for all drilling operations. It is now used only for new mud that is desired and for the supplying of heavier fluid than is generally required, as in the case of Lloyd No. 57.

The entire mud system of the Associated Oil Company is a flexible unit and can meet the rather severe conditions which will probably be placed on it by the deeper drilling which will eventually be done.



The classification plant in the Ventura avenue field, California.

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Progress in Manufacture of

Lead-Containing Lubricants

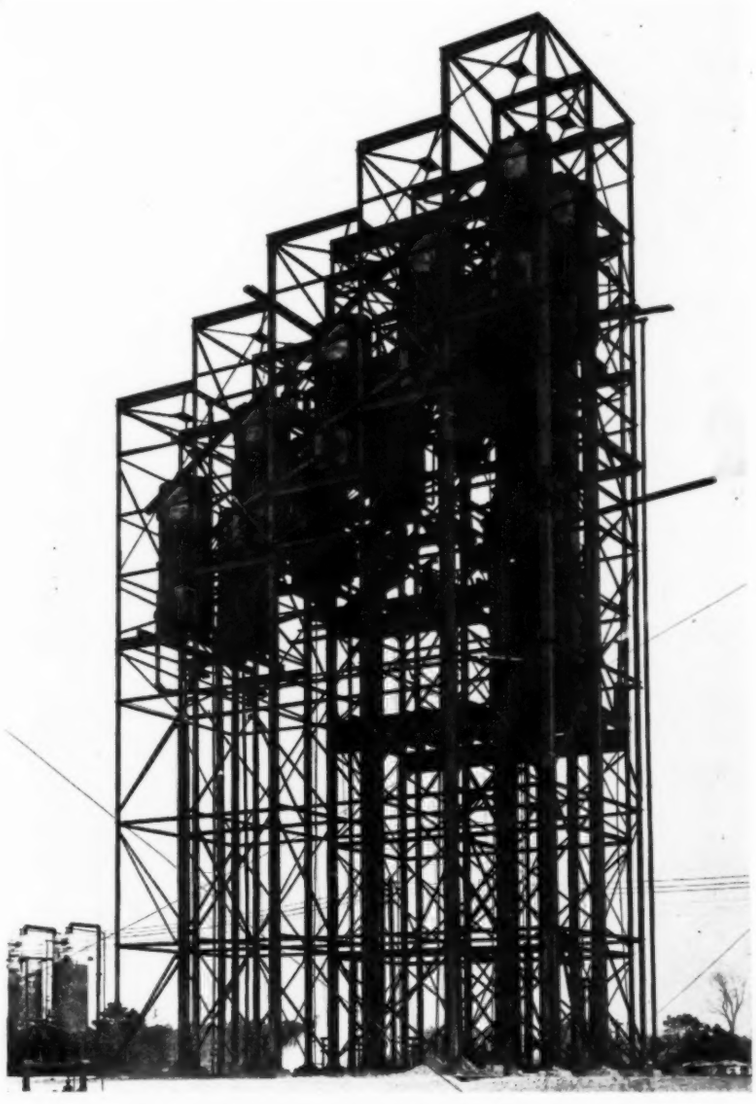
By FREDERICK C. OTTO, *Consulting Engineer*

LEAD-BASE lubricants have been known for fifty years, but have heretofore been manufactured only in small amounts by manufacturers of specialties. Since the General Motors Corporation has taken up the matter of lead-loaded lubricants and the Gleason Gear Works insists upon lead-base lubricants for its Hypoid gears, a decided change has taken place. Lead-base lubricants are the topic of the day, and the progressive grease manufacturer is confronted with the demand for them, especially for automotive equipment.

There are three distinctively different representatives of the family of lead-containing lubricants on the market. Two groups are rightly called "lead-base" and the third group must be classified as "lead-loaded or lead-containing." The "lead-base" lubricants are divided into "mono-saponified" products and in "two-fold saponified" products, the latter also called "double decomposition" products.

Reasons for Superiority of Lead-Base Lubricants

The principal reason for the sudden popularity of lead-base lubricants is their pressure-resisting properties. A secondary reason is that they flow at very low temperatures, even though they may be considerably lower than the cold test of the mineral oil used in the compounding. A third reason is their comparatively high water-resistivity, and a fourth the fact that a grease or oil of a certain consistency is able to absorb a larger percentag of lead soap as compared with lime, soda, aluminum or any other of the commercially practical soaps. For illustration, it may be pointed out that a 200 viscosity neutral oil, containing 15 per cent calcium soap, will result in a No. 2½ cup grease, and when combined with 15 per cent of sodium soap will result in a medium fiber grease. The same grade of oil combined with 15 per cent of aluminum stearate will produce a tough transparent grease of almost No. 3½ consistency; whereas, the addition of 15 per cent of lead soap to the same grade of oil will result in a free flowing lubricant, having a consistency between 00 and 0. This property of lead soap enables the compounder to reduce the amount of mineral oil in a given consistency and to employ a larger amount of that part of the lubricant that has to carry the brunt of pressure and friction.



Lube oil still, McMillan Refining Co. plant, Norphlet, Ark.

Three Methods of Making Lead-Containing Lubricants

A number of grease experts prefer mono-saponified lead-base lubricants over the double-decomposition products, chiefly for the reason that experience has shown that the former product will keep the lead soap longer in suspension than the latter. This is true not because of real superiority of one kind over the other, but only because of the fact that the manufacture of double-decomposition lead-base lubricants has not been studied thoroughly, the manufacture heretofore having been left mainly in the hands of grease plants with limited means available for research. To illustrate this, it may be pointed out that even that brand of lead-base lubricant, which is considered at the present time as a leader, will in less than three months precipitate from four to six inches of lead

soap in a drum of 400 pounds net content. The brand referred to is made in the two-fold saponification manner. The mono-saponified products, as well as the lubricants prepared by using the double-decomposition method, find ready application in the manufacture of liquid and semi-solid lubricants; as, for instance, for the lubrication of gear sets and rear-end assemblies of automotive equipment. The textile industry also makes use of this kind of lubricant in the form of the so-called slow-flow greases. Lead-loaded lubricants are generally of heavier consistency, necessitated by the tendency of the lead compound to settle out of the finished lubricant. It has become a practice among some manufacturers to add flowers of sulphur to the lubricant in order to support the lead in staying longer in suspension. This practice has even found the support of a few automotive engineers.

Melting Point of Semi-Solid and Solid Lead-Base Lubricants

Each industrial and automotive lubricant requires a certain predetermined melting point. By using different kinds of fatty oils in the manufacture of lead soaps, it is possible to attain either a high, medium, or low melting point. For the manufacture of lubricants to be used in the open—that is, exposed to cold weather during the winter months—a lead soap of low melting point should be used. If the lubricant is intended for use in closed industrial plants or has to be applied near heated machinery, then a high melting point lead soap should be selected. The following table illustrates the flexibility permissible in manufacturing and compounding:

Lead, Salts of	*Melting Point—Fahrenheit*
Oleic Acid	113 —— 122
Caproic Acid	163 —— 165
Caprylic Acid	182 —— 184
Heptylic Acid	194 —— 196
Nonylic Acid	201 —— 203
Capric Acid	210 —— 215
Lauric Acid	217 —— 219
Myristic Acid	224 —— 225
Palmitic Acid	234 —— 235
Stearic Acid	257 —— 260

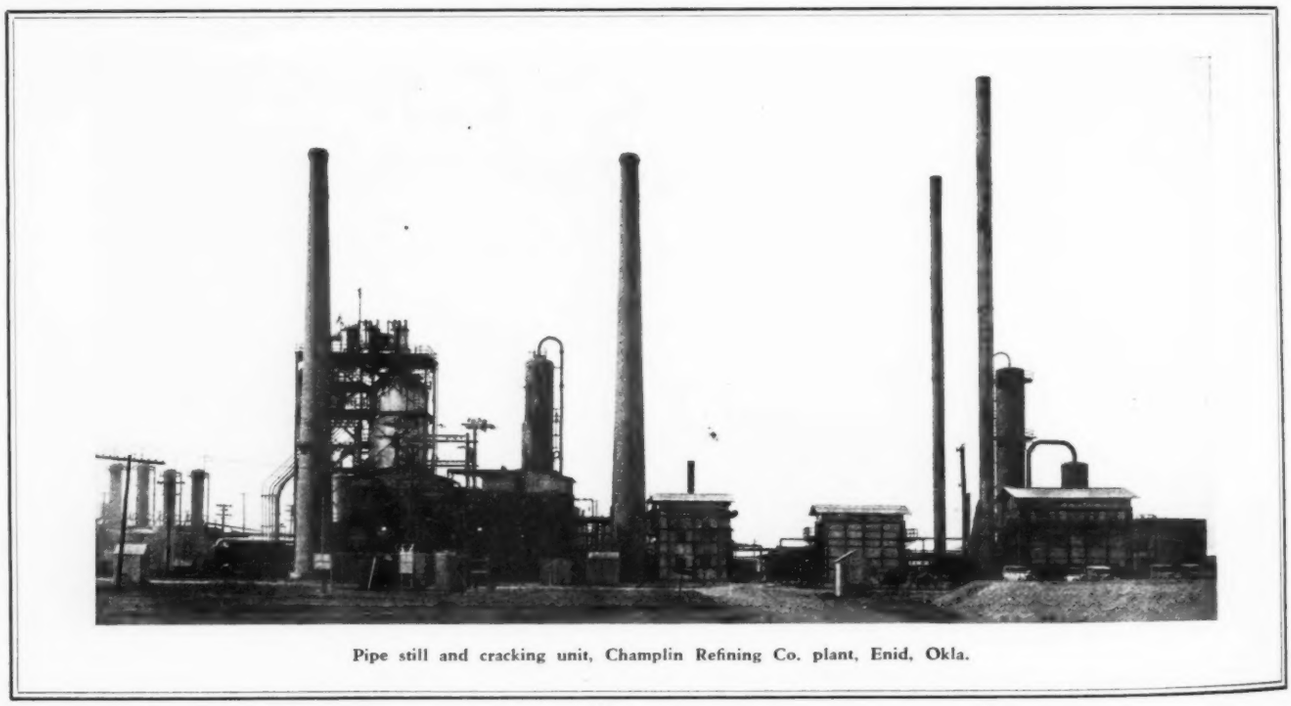
The practical compounder and grease manufacturer is concerned especially with oleic acid, lauric acid and stearic acid. He uses the first named for slow flow lubricants and zero test greases; he makes use of the rosin acid for waterproof greases of great pressure resistance, and he employs the stearic acid when making high-priced specialties.

Manufacture of Mono-Saponified Lead-Base Lubricants

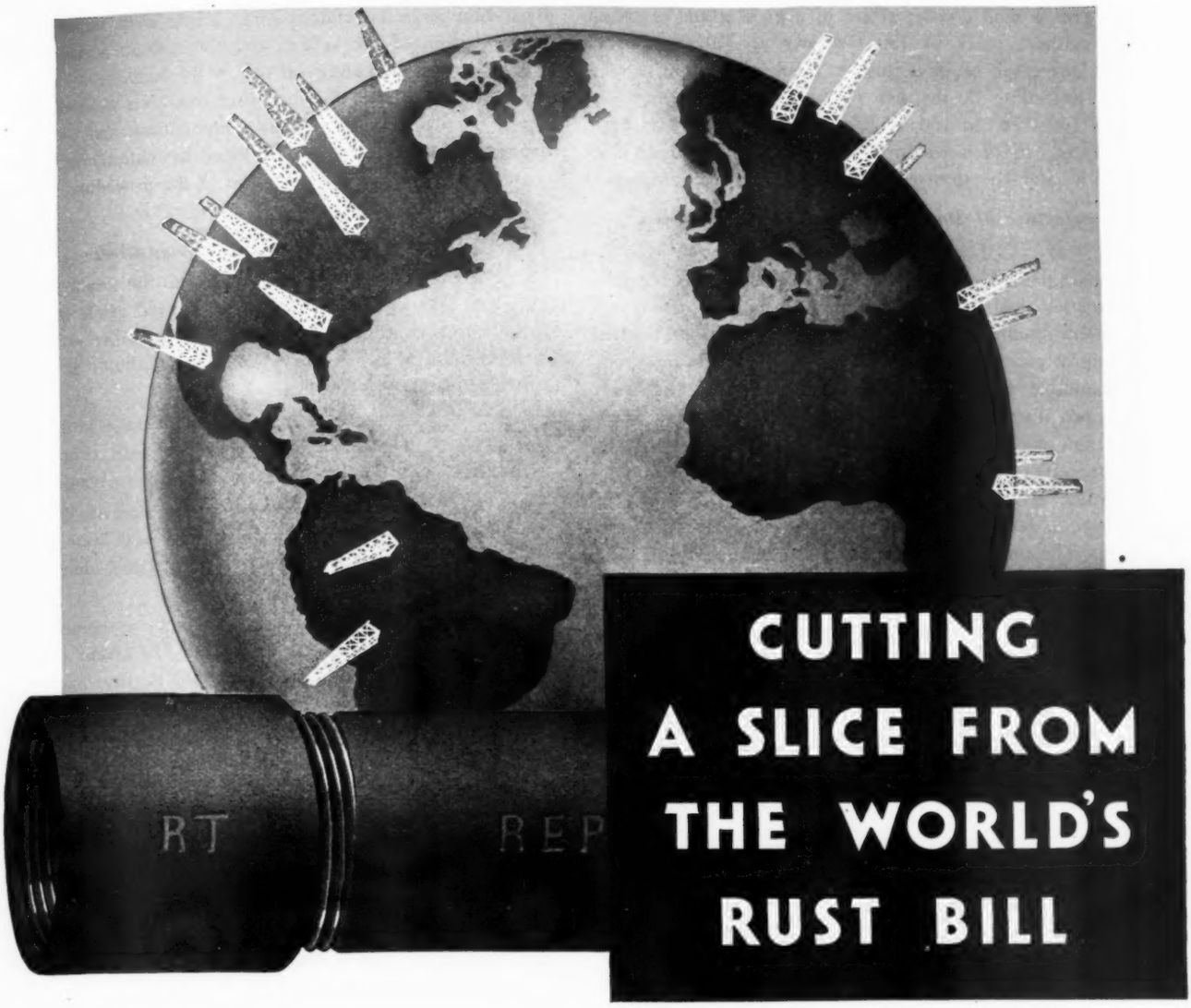
The fundamental process of manufacturing direct saponified lead oleate was already known in 1877 when E. E. Hendrick was granted a patent claiming the manufacture of a lubricating compound by heating equal parts of white lead and whale oil and diluting with mineral oil to the desired consistency. Thirty years later, in 1907, the United States granted another patent covering the heating together of lead, animal fat and mineral oil. In 1926 Gundy was granted a modification, calling for oleic acid instead of whale oil; lead oxide instead of white lead; besides fixing the heating temperature not to be in excess of 530 degrees F.

The manufacture of mono-saponified lead-base lubricants consists essentially of the preparation of a lead-soap (usually lead-oleate) and its dilution with mineral oil to the desired consistency. The latter may vary from A. S. T. M. Penetration 100 to semi-solid, or in case of lead compounded oils to S. U. Viscosity of 200 at 100 degrees F. Lead oleate may be manufactured by mono-saponification in open-fired kettles from oleic acid or whale oil and lead oxide or lead carbonate.

A practical formula for the manufacture of a high priced lead-base gear and transmission lubricant, which has been used for a number of years by a well known manufacturer, has recently been made public and calls for 11.8 per cent whale oil charged into an open fired kettle and heated to about 500 degrees Fahrenheit. While the oil is constantly stirred, 4.2 per cent lead oxide is sifted in and the temperature is kept constant for approximately two hours, maintaining a vigorous agitation during this time. When the basic lead soap has been formed, the temperature of the mass has to be lowered and should not exceed 20 degrees F. below the fire point of the mineral oil intended to be used in the manufacture. The 84 per cent mineral oil needed to make



Pipe still and cracking unit, Champlin Refining Co. plant, Enid, Okla.



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Manufacture of Double-Decomposition Lead Soap Lubricants

The manufacture of lead-base lubricants by using double-decomposition lead soaps is preferred by most compounders, because this method consists essentially of nothing but the dissolving of a certain amount of previously made lead soap into a suitable mineral oil. The lead soaps are available on the open market and can be bought at a cost not much higher than the price would be if the soap were made by the compounder himself. The lead soaps are usually marketed either as lead oleate or lead stearate. They can be made from a large number of readily available fatty oils and fats. The more commonly used raw materials for lead soaps are whale oils, fish oils, oleic acids, stearic acid, castor oil, neatsfoot oil, woolfat, degras, woolwax, rosin, rosin oil, and naphthenic acids. Beeswax is also used, though sparsely on account of the high cost; linseed oil, however, is oftener used, especially in preparing lead oleate. Naphthenic acid is employed when a high melting point of the oleic acid has to be combined with a low price. In preparing lead soaps by the double-saponification method, the manufacturer prepares first a regular alkali soap, and after that soap is entirely satisfactory the second step is taken, consisting of substituting lead for the alkali used in the making of the soap. The manufacturer has the choice of the alkali, and it is only a matter of convenience whether he employs sodium hydroxide or potassium hydroxide. Since the alkali is subsequently removed and gives place to the lead, there is no noticeable difference in the finished lead soap. Because sodium is the cheaper commodity, it is generally preferred. Considering the fact that the consumption of lead oleate constitutes almost 95 per cent of all lead soaps, only this class of lead soap will be discussed.

The Nature of Lead Oleate

The chemical formula for lead oleate is $Pb(C_{18}H_{33}O_2)2$. Before lead oleate entered the field of lubrication, it has been used widely in pharmacy, known as lead plaster. It appears as a sticky brown mass, ranging in consistency from a soft ointment to a very hard and tacky candy. It is supposed to be soluble in mineral oil, but experience has convinced practical oil men that it is hard to hold in solution or suspension. Only a limited number of mineral oils are adaptable for use in lead-base lubricants. The majority of mineral oils will hold only a small percentage of lead oleate in suspension. It takes skill and experience to select the proper oils. The manufacture of lead oleate requires a steam jacketed kettle and a steam pressure of 85 pounds. The process consists of the saponification of 100 parts of oleic acid by means of from 15 to 16 parts of sodium hydroxide. When saponification is completed, the sodium soap has to be thinned down with water, and 67 to 70 parts of lead acetate must be added. After some time the latter splits into lead and acetate, the former uniting with the oleic acid and the latter uniting with the sodium. Thus the sodium soap has changed into a lead soap, sinking down to the bottom of the kettle; and the sodium acetate, being lighter in weight, riding on top of the soap, from where it is pumped off. After the lead soap has been washed repeatedly, it is ready to be used in compounding and for grease manufacturing. For those interested in manufacturing lead oleate, a more detailed description of the procedure is given in the following paragraph.

How to Make Commercial Lead Oleate

Step No. 1. Charge the oleic acid into the steam jacketed kettle and add to it 300 per cent of a good grade of water. If the latter contains too much salt, a distilled or treated water is preferable. Turn on steam and agitator and maintain temperature of 130 degrees F.

Step No. 2. Dissolve the sodium hydroxide in 1500 per cent water. When this lye has reached room temperature, charge it through a sieve into the kettle and stir continuously.

Step No. 3. Maintain the temperature for one hour between 150 and 200 degrees F. and for the next hour between 200 and 212 degrees F., stirring continuously during that time.

Step No. 4. By this time a satisfactory sodium oleate should have been formed. Sample should be taken, and after carefully drying the consistency should be determined. If the mass is too soft the amount of sodium hydroxide was insufficient or the boiling time was too short. If the mass is too hard or brittle phenolphthalein test should be made, and if free alkali is present some fresh oleic acid should be added.

Step No. 5. If sodium oleate is as desired, 1000 per cent of water should be added and the temperature kept for one hour at 130 degrees F.

Step No. 6. The lead acetate has to be dissolved in 500 per cent of water and charged into the kettle as slow as possible and in a thin stream. The temperature should then be maintained at 180 degrees F. for approximately one-half an hour.

Step No. 7. Agitator has to be stopped and steam supply has to be turned off. The lead has in the meantime combined with the oleic acid and settles on the bottom of the kettle.

Step No. 8. The acetate has combined with the sodium and forms a solution on top of the soap. This solution has to be syphoned or pumped off.

Step No. 9. Wash the soap repeatedly with fresh water until all traces of sodium hydroxide have disappeared.

Step No. 10. Turn on steam and agitator. Heat for two hours until all water has been evaporated. The lead soap is now dry and can be run into containers.

Pressure Resistance of Lead-Base Lubricants

For some purposes lead-base lubricants are rapidly taking the place of sodium-base and calcium-base greases. Especially in the automotive transportation, where a very unctuous, free-flowing grease is required, lead-base greases are readily recommended. The lead in the base has the tendency to go into intimate connection with the steel and it is believed that the close connection is of a chemical nature. Tests have been made where high grade sodium lubricants and internationally known calcium lubricants have resisted in rear-end drives only a teeth pressure of 8,000 pounds;

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whereas, under same working and testing conditions the lead-base lubricant withstood a teeth-pressure of more than 25,000 pounds. The mineral oil used for the compounding of the lubricants has been the same in all tests and only the basic oxides and fats varied. On the other hand it has to be admitted that the good reputation created for lead-base lubricants is decreasing due to the fact that a number of small plants have turned out lead-base lubricants which are compounded with cheap black oils instead of a good grade of mineral oil. The well meant addition of free sulphur to such cheap leab-base greases makes the matter only worse. Greases of such nature will deposit asphalt and sulphur in the gear cases and rear axle housings and will leave for the actual lubrication only a thin mineral oil containing an insufficient amount of lead soap.

Moisture Resistancy of Lead-Base Lubricants

Lead-base soaps and lead-base lubricants do not emulsify or dissolve in water. Lead soap, when in dilute solution in oils, is affected by the presence of moisture, which has the tendency to precipitate the lead soap. For this reason compounds of mineral oils and lead soaps should be kept in closed containers. Tests which have been made on a commercial grade of motor oil which contained less than one per cent of lead soap did not reveal any precipitation as long as the oil was kept in drums or highboys; but showed precipitation as soon as the oil was left in open unprotected containers. It is a known fact that sodium base lubricants very often boil out due to the amount of moisture left in the grease when shipped from the grease plant. As soon as the heat in the gear case of a truck is in the neighborhood of 200 degrees F., the truck owner has to look out for trouble. Lime-base lubricants, on the other side, will become crumbly when the heat in the gear and transmission cases is intense enough. The result is an evaporation of that small amount of moisture that has to remain in lime-base lubricants in order to keep the soap together. Whenever heavy equipment shows a temperature in excess of 180 degreets F. in transmission and rear end cases, the use of lead-base lubricants should be prescribed. A lead-base lubricant is always superior to an aluminum-base lubricant when used for the lubrication of rear end and transmissions running at abnormally high temperature.

Lead-Base Transmission and Gear Lubricants

Prior to the dawn of the Hypoid gears and to the development of special lubricants to meet the demand of that kind of gears, there were on the American market two grades of lead-base lubricants which were able to acquire a considerable reputation. The analysis of the leading lubricant, which has been recommended by a majority of well known automobile manufacturers, is as follows: Combined fatty oils, 6 per cent; unsaponified fatty oils, 0.75 per cent; litharge (lead oxide), 2.85 per cent; water, 0.55 per cent; black oil of 100 viscosity at 210 degrees F., 84.18 per cent; asphalt content of the mineral oil portion, 6 per cent. The friction curve of this lubricant is not as good as the friction curve of a lime-base transmission lubricant of the same consistency, but its noise-preventing properties and the lower cold test have made that lubricant very desirable.

The analysis of the other leading lead-base transmission and gear lubricant is as follows: Gravity A. P. I., 11.5; color, deep black; flash point, 358 F.; fire point, 410 F.; cold test, zero F.; viscosity S. U., 78 at 210 F.; fatty oils, 9 per cent (apparently fish oil); ash, 3.4 per cent, determined as lead oxide.

Lead-Loaded Lubricants

The film-forming and sound-silencing properties of lead have been known for a long time. Back in 1880, P. F. Fitch was making use of the fact that lead silences the clattering of gears. He was granted a U. S. Patent for a lubricating compound, consisting of sodium soap dissolved in water, filled with sal soda, carbonate of ammonia, sal ammoniac and red lead to the desired consistency. Simmons knew that the pressure-resisting qualities of a lubricant would increase with the increase of the lead content. Since technical reasons make it impossible to increase the lead content in boiled greases unlimited, Simmons resorted to the way shown by Fitch—that is, the mechanical admixture of lead into an otherwise complete lubricant. In 1907 the U. S. granted him a patent on a lubricant which was made by the saponification of 25 per cent animal fatty acid or beef tallow with six per cent caustic soda, leaving nine per cent water in the finished grease, to which 30 per cent graphite and 30 per cent white lead were added by mechanical agitation.

To the G. M. C. Metallic Grease Co. has been issued a patent, which was issued in 1922, following the lines of the Simmons patent, granted in 1907. The claims made for this application center around a mechanical admixture of 97.43 per cent regular cup grease, 1.96 per cent lead dust, 1.49 per cent babbitt dust and 0.12 per cent white lead. It is apparent that this lubricant acts as a cushioner and is suitable for a number of rough lubrication problems.

The Probable Potential Development of Lead-Base Lubricants

Lead-base lubricants have received during the last six months several severe blows. This setback is not due to the principle of employing lead soaps; it is rather a result of a too-sudden demand which found a number of grease plants not prepared. Subsequently, a number of products were marketed which did not live up to the expectations of manufacturers of automotive equipment. The reason for the failure of some brands of lead-base lubricants is twofold. One principal reason is the employment of cheap black oils of insufficient viscosity. This drawback can be overcome by the employment of high-grade cylinder stocks or by the use of vacuum distilled overhead bright stocks. The second reason for the failure of some brands of lead-base lubricants is the precipitation of the lead soap. This also can be overcome. All that is necessary is to run a number of sample batches, using a variety of oils of different viscosities and of different base. When such sample batches are kept for a certain time—that is, not less than six months—the compounder will be able to reject some oils which will hold the lead soap good in suspension and he will be able to reject a number of other oils which are unfit for the manufacture of fluid lead-base lubricants. The writer has made such studies and has been able to select oils which hold the lead soap in suspension even after 20 months standing. Asphaltic-base bright stocks of viscosities in excess of 150 at 210 F. are especially suitable for supporting lead soaps. Such lubricants do not require fillers, as talc, sulphur, or other solids, and are able to withstand great pressure without any lapping action.

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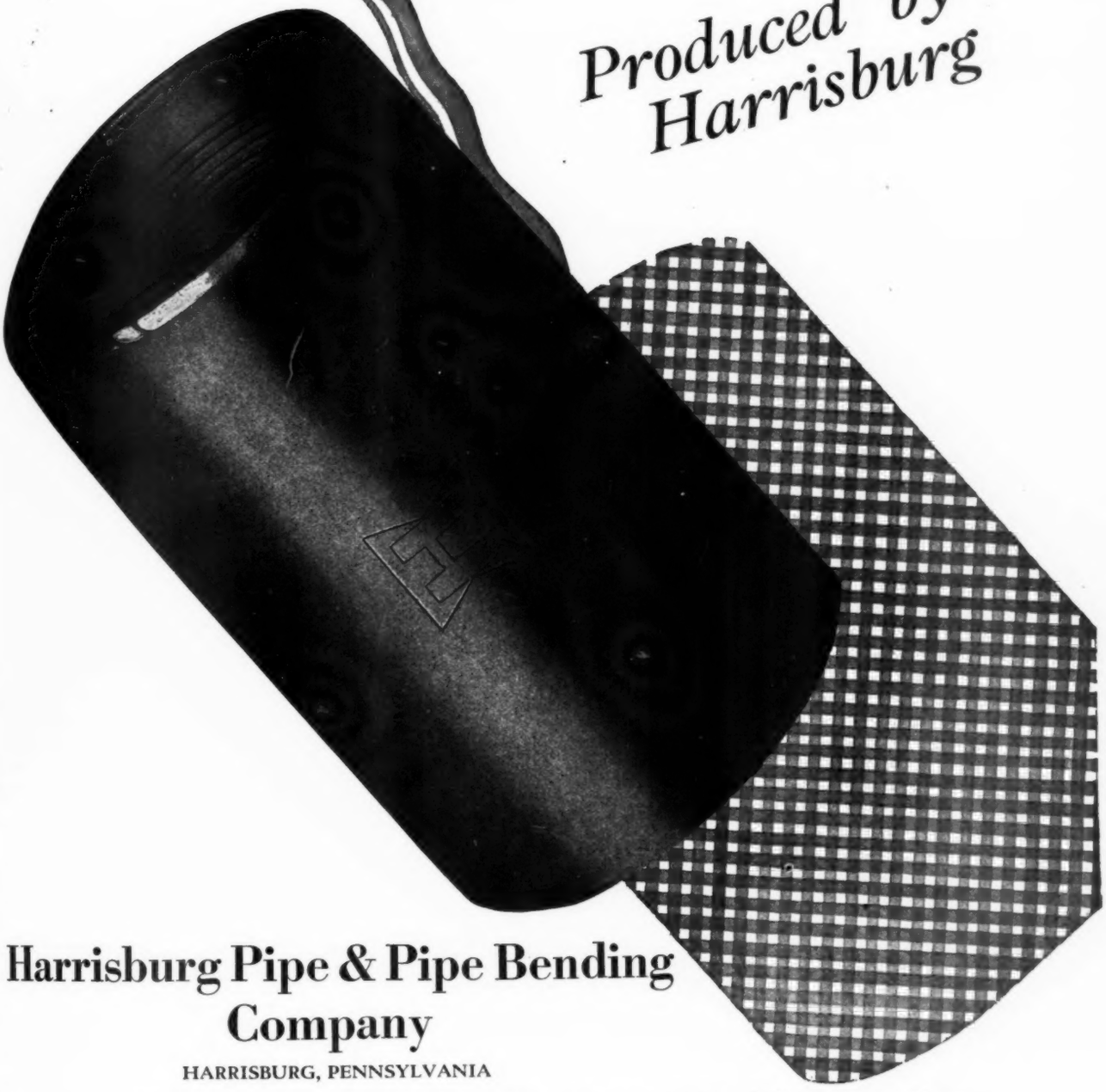

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Interesting NEW JACK HOOK-UP

Pumps Two Wells Successfully

A NEW pumping practice proving popular where it has been installed is a two-well hook-up of pumping jacks, in which one well is counterbalanced against the other. One motor-equipped jack operates the other by a rod line running from the rein head of the motor-equipped jack to the same position on the other. The movement of the power jack's rein head giving the rod line a pull similar to a band wheel's operating principle.

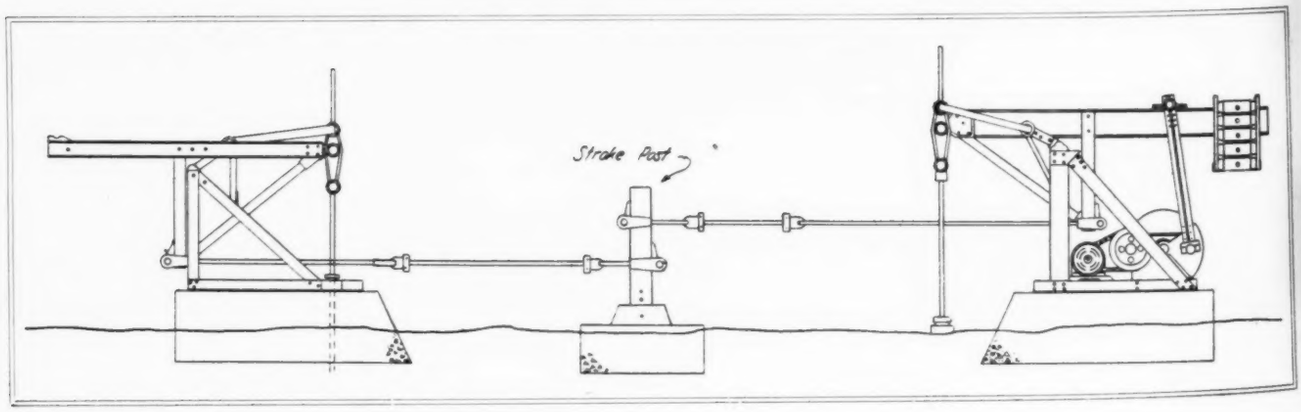
Installations of this kind represent a saving in expenditure and a saving in lifting cost, since the power consumed is not a great deal more than that consumed in operating one well.

The equipment generally used for such installations is a regulation pumping jack operated by a five or 10 horsepower electric motor through a worm-gear or V-belt drive, a rod line operated jack and the necessary rod line between the two wells. Several of these units have a stroke post in the rod line, making it possible greatly to shorten the stroke on the second well. This is accomplished by moving the castings on the stroke post up and down to secure the desired stroke length.

The lifting stroke of the jacks is alternative, the rein head of one jack naturally being in the opposite position from the other, thus keeping the entire load from being thrown on the motor at the same time and giving the unit an easy, smooth movement. The power jack is always placed on the heavier of the two wells.

The Stanolind Oil & Gas Company has an installation of this kind in the Beebe (Okla.) field that has proven a successful and economical lifting power. The power jack is pumping a well 2,545 feet deep with a 29-inch stroke at the rate of 17 strokes per minute. The other well, located a full location away, is 1,737 feet deep and is pumping on a 33-inch stroke. The deeper well is quite a heavy well, as it makes a large quantity of water, yet neither well has given any trouble during the five months since it has been installed. Both of these wells are tubed with two-inch upset tubing.

A good many installations of this type are in use in Texas and several in Oklahoma and other parts of the Mid-Continent.



Left — The electric motor-equipped jack. Below—Drawing showing the two-well hook-up of pumping jacks.

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Use *of* Streamlined Pitot Tube *in* Testing Gas Wells

By JAS. E. SHOBE, *Continental Oil Company, Ponca City, Okla.*

SINCE the development and presentation to the gas industry and its subsequent acceptance of the so-called "Bureau of Mines" or pressure-drop method of testing gas wells, the pitot tube has lost a great deal of prestige. This is, no doubt, as it should be, since the pressure-drop method, besides being more economical from a gas wastage standpoint, incorporates several refinements born of a careful study by experts of the actual conditions in a well, the physical characteristics of the gas as a whole, and of its components severally.

There are times, however, when a well's physical condition in one or more respects will not permit the use of the pressure-drop method of testing; as an instance, in the case of a well which is very wet and which is cased with large diameter pipe. The velocity of the gas being measured through the meter against the existing line pressure during the period of testing frequently is not sufficient to lift the water. This results in a rapidly declining pressure curve and an exaggerated final result. But whatever the conditions may be where the pressure-drop method of testing is thought inapplicable, the next resort is usually the pitot tube.

The old standby pitot tube known to everyone is good only for determining a close approximation of a gas well's potential production. There are several drawbacks to its use. Among these might be mentioned: the specific gravity of the gas may not be known with sufficient accuracy, the true internal diameter of the pipe and the effect of the possible vapor content of the gas with respect to its impact pressure. Some very constructive research work toward establishing values or constants for impact pressures above the critical point has been done by Reid.[1] This somewhat enhances the value of the pitot tube as previously there was some doubt as to the value of the tables formerly used.

The primary purpose of the pitot tube is merely to obtain the impact pressure of the gas as it emerges from the opening. Therefore, while serving this purpose, it should not present any impediment to the stream flow of the gas. This condition approaches perfection and is therefore unattainable, but certain refinements in the tube itself can appreciably diminish its impedance to the gas stream. One method is what is called by aeronautical engineers, streamlining. This is the process of shaping an object which is to pass through a gaseous medium at high velocity in such a manner as to present a minimum of resistance both in front and behind. When we say "behind," one is inclined to think this is possibly a misprint. It is true that the vacuum behind a non-streamlined object moving rapidly through a gas is almost one-half of the pressure in front of it. (See illustrations.)

In Figure 1 the object is not streamlined. There is a pressure in front of it and a vacuum behind it, both contributing to its resistance and disturbance. In Figure 2 the object is streamlined. There is set up only a slight pressure in front of it and little or no vacuum behind it, because the lines of flow meet smoothly and continue on their way comparatively undisturbed. Figure 1 might represent the cross-section of the common pitot tube which is usually made of one-quarter-inch pipe. This shows graphically the result obtained when used in a gas stream of high velocity.

The writer has used a pitot tube shaped like Figure 2 with highly satisfactory results for two years. The one in use at present has not only the "handle" but the impact head streamlined as well. A diagrammatic sketch of this tube is shown in Figure 3.

As will be observed, all elements are streamlined to present as little resistance as possible. This form of tube can be used in a much smaller opening with assurance of greater accuracy than the common type. This is of course due to its decreased impedance and disturbance. Another feature worthy of mention is that in testing a large gas well in the Mid-Continent sometime ago, two men were unable to hold a common type pitot tube over the hole, whereas the streamlined type described here was held steadily in position by one man unaided.

It was noted early in the use of this tube that the excessive vibration on the pressure gage, so often observed when used with a common type of tube in a gas stream of extremely high velocity, was conspicuously diminished in the streamline type. Whether this is due to the streamline design or due to the "pocket" in the impact head breaking up the vibration period the writer is unable to say.

In the present design the impact head is made of German silver, or what is commonly known as "hot tube" metal. This is to obtain both hardness and non-corrosive properties. The handle is of seamless brass tubing, which, after being annealed and shaped, is brazed to the head. A three-sixteenths hole through the wall of the head communicates with the handle. Proper provision is made on the end of the handle for the attachment of a pressure gage or U-tube.

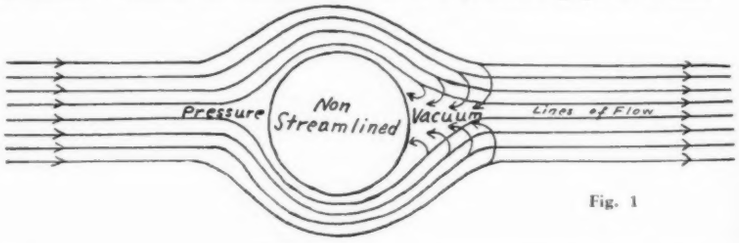

Fig. 1

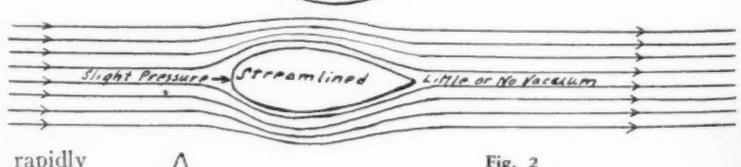

Fig. 2

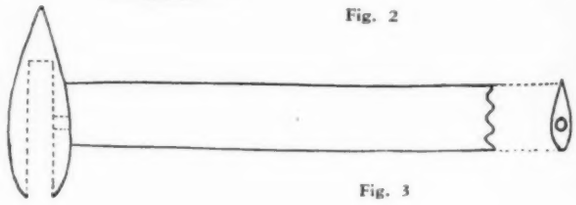

Fig. 3

[1] Walter Reid, Consulting Gas Engineer, Dallas, Texas.

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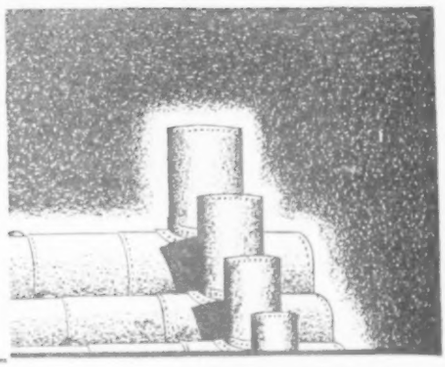

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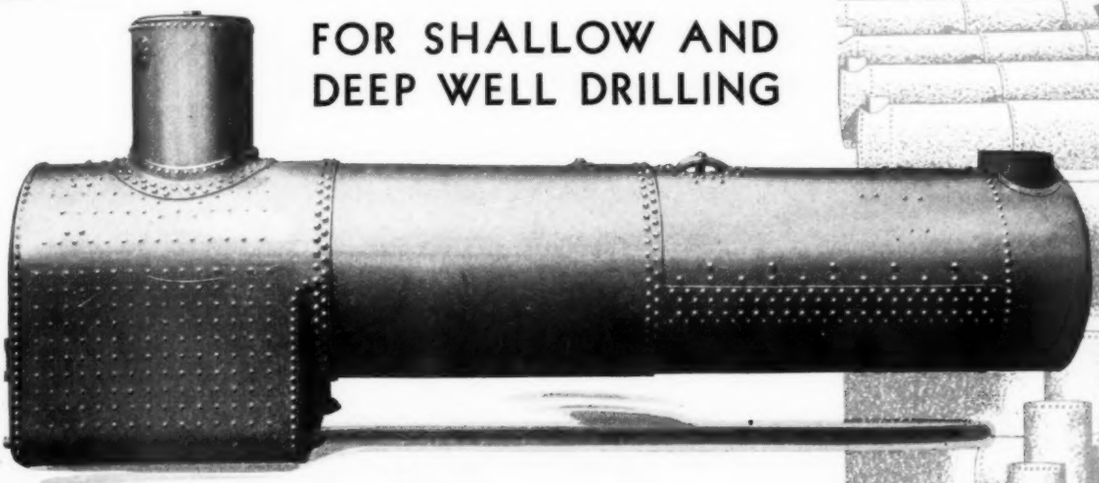

Horse Power	Working Pressure
25	125
—	—
—	—
—	—
75	200
85	200
100	200
75	250
85	250

Horse Power	Working Pressure
100	250
125	250
125	300
125	350
SUPERHEATERS	
75	300
85	300
100	300
125	300

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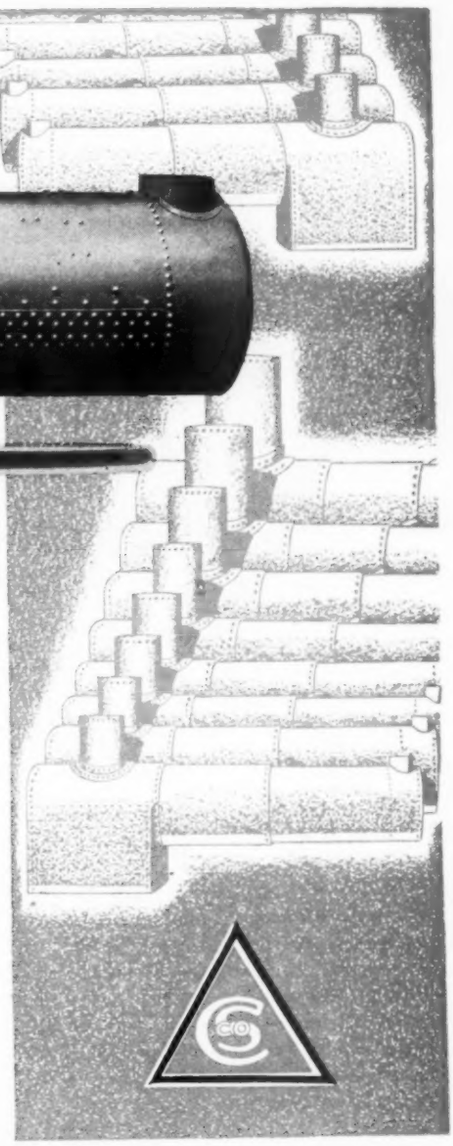

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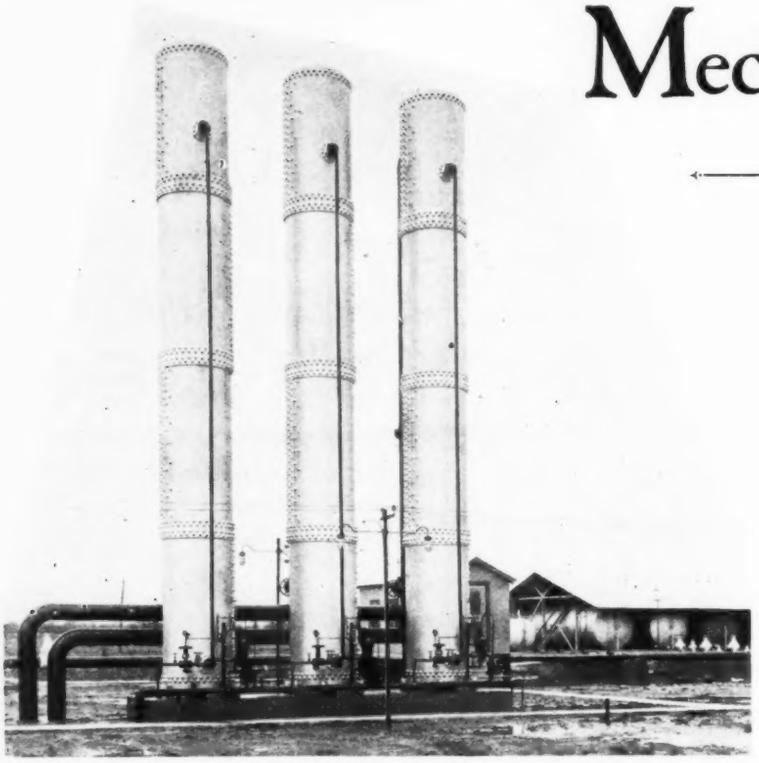
Mechanical-Minded

By A. J. Mac
United Carbon



High pressure absorber, United Carbon Co., Richland Parish, La.

IT SEEMS rather strange that an industry that has progressed so far in a technical way, and has developed its equipment upward to its present state of efficiency, often pays so little regard to the selection of mechanically trained men for the operation and maintenance of equipment.

The general reaction to such a suggestion is that it is not necessary to employ skilled mechanics to operate equipment that has been correctly designed and expertly installed, and that no particular degree of intelligence is required to open and close valves and to watch things generally, as long as a good foreman is in charge of operation. This attitude is due usually to a lack of appreciation of the practical side of the mechanics of plant operation and maintenance.

The processing of gas for the extraction and subsequent treatment of gasoline involves principles of chemistry and physics, both of which are exercised through mechanical means entirely.

In the problem of plant operation the foreman has at his disposal, for the purpose of producing the finished product, a great variety of equipment, all mechanical. Some pieces of this equipment do not have moving parts but are subject to pressure, others are subject to pressure and having moving parts, are also subject to wear. Still others are subject to various conditions of stress, including pressure, wide temperature range, wear, corrosion, etc.

Practically all equipment having moving parts, such as engines, pumping equipment, electric generators, motors and the various kinds of control equipment are machined to very close limits of accuracy. That the continuance of the degree of efficiency and economy that the apparatus was designed to perform be maintained for as long a time as possible, economically, certainly required the attention and service of men skilled in the mechanical trades.

It is quite true that an operator or foreman, not skilled in mechanics, may be able to maintain continuous operation, but the cost sheet will invariably show the difference, if intelligently and honestly prepared. To such an operator a pump or engine may appear to be running nicely and to him perfectly satisfactory, while due to excessive wear in some of its parts or to misalignment, the machine may be consuming horsepower far beyond the figure at which it should economically work. The trained mechanic, as a result of his training, anticipates these troubles and prepares for their removal, thus avoiding irrecoverable losses due to hasty shut-downs, long before they become apparent to the man who has not had the benefit of expert training in matters mechanical, and who is content as long as the machine is running and not until it breaks down is he concerned with the problem of repair, which to his notion, consists of merely replacing the broken or worn part with a new one. The new part may fit and again it may not, but as long as he installed it and the machine is running again he is satisfied.

An examp'e of this kind of work is the case of the man who is not a mechanic and who owns a car that needs an overhaul job. He decides to do the work himself. After taking the motor apart he reassembles it, installing many new parts, most of which must fit and be adjusted very carefully, in order that the car may perform its duty as it should. With no mechanical training whatsoever he undertakes to do a highly specialized piece of work, confident that he can do it as well as an expert and at much less cost. He proves it to his own satisfaction by succeeding to make the car run again and is satisfied that he has done a good job because he is sure that all the pistons, rings, bearings, etc., are tight. But tight does not mean fit — a fact that the trained mechanic understands, for an important part of his training is that a part does not necessarily fit because it is tight. The failure of the car to come up to expectations in the matter of performance and endurance later on is attributed to poor material or to some other cause.

With the individual who overhauled his car, and with the employer who does not recognize the economic value of employing skilled mechanics to do mechanical work, the result is the same: the owner pays the difference. It is hardly necessary to state here that the difference is in favor of correct mechanical procedure. In plant operation this difference may be quite an appreciable sum, for the operation of a piece of equipment is continuous and any deviation from maximum efficiency due to its improper mechanical condition, be it ever so small, accrues to a surprisingly large total. This sum may find its expression in terms of loss of potential production or in an addition to potential cost per unit of production volume or to varying degrees of both, either of which is a perfectly legitimate chargeable item. A persistent refusal to recognize or investigate such an important detail can hardly be said to be consistent with good business methods.

It is in the matter of repair that the skilled mechanic comes into his own and where his ability to effect repairs correctly is a real asset. Frequently he is able to salvage and repair worn or used parts at small cost, so that they may

ness *in the* Natural Gasoline Plant

KINNON, *Supt.,*
Company

serve fully as well as if replaced with the much more expensive new parts. During shut-downs, emergency or otherwise due to his proficiency and judgment, he is able to expedite repairs, thus lessening materially the irrecoverable losses occasioned by these interruptions in plant operation. The judicious use of tools and material go a long way to keep maintenance costs down where they belong.

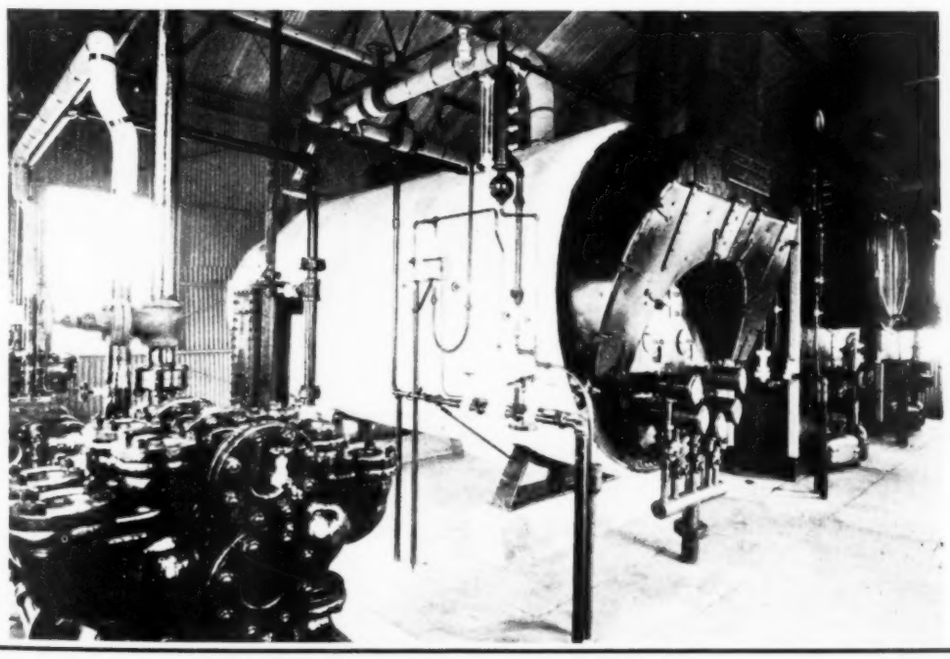
The skilled mechanic who has acquired his training under the guidance of other trained and experienced men takes a pardonable pride in the knowledge that he is able, not only to do things, but to do them well, which means quickly, neatly and economically. By virtue of his training the skilled mechanic makes a better operator than he who has not had the benefit of this sort of experience. His judgment of stresses, distances, etc., is better developed than is that of the other fellow and other qualifications being equal, the mechanic will prove to be the better operator.

Then there is the very important matter of safety to life and property to consider. This feature of the trained mechanic's education makes him an invaluable safety factor in plant operation, for no matter how fool-proof a plant or any of its parts has been designed, there are times when a person's judgment must decide quickly — a question that may mean the difference between safety and disaster. Especially is this important where so many pressure vessels are employed, as is the case in the natural gasoline manufacturing industry. Consider the boiler for instance and try to realize what percentage of plant operators have a correct conception of the enormous amount of energy stored up in one, and its potential danger. The writer one day walked into a boiler room and found an operator of long standing replacing a 1-inch fusible plug in the crown sheet of a boiler. He was using a U. S. S. 1⅛-inch taper tap to chase the threads in the crown sheet. The fact that the tap had 8 threads and the plug 1½ did not mean anything to him. Those who are prone to scoff at the importance of the safety of life and property of the use of skilled mechanics are referred to their favorite boiler inspector or master mechanic for opinion regarding the plug incident just mentioned and the potential danger involved due to a situation that makes such procedure possible.

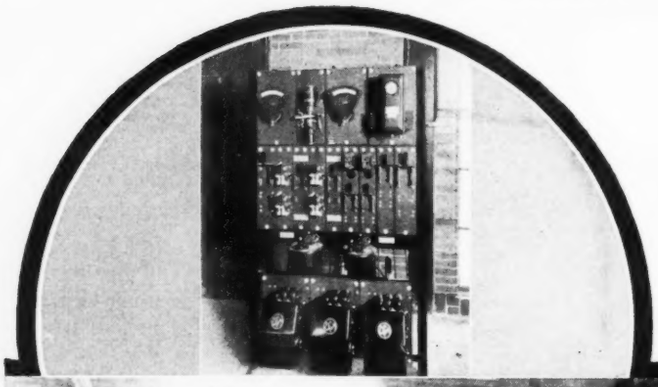
In order that the mechanical efficiency and safety of equipment be maintained to the degree of perfection that is consistent with good engineering practice, every plant should have in its operating personnel at least one member who has had the benefit of proper machine shop training along with some technical knowledge of mechanics. Such an employe, if possessed of any natural adaptability as a mechanic is an asset to the organization, the value of which is far in excess of the remuneration he usually receives.

In other industries long experience has proved the importance of recognizing the value of a good mechanical force, so that, as a matter of course, the trained mechanic is credited with the rating that his occupation deserves, a detail that in the natural gasoline manufacturing industry is so frequently overlooked.

Of course it is not contended that all plant operators should be skilled mechanics, for such a provision would be impracticable, but the contention is made that more attention and care in the selection and training of operating forces along the lines mentioned in this article will show a substantial return on whatever investment it involves. Apart from whatever artistic value one may place upon proper mechanical procedure, it is after all an economical problem and the economic value of the policy of mechanical-mindedness, though in a sense an intangible asset, is nevertheless, as real as any of the more tangible assets which appear in the balance sheet.



Boiler house, United Carbon Co. gasoline plant, Richland, La.



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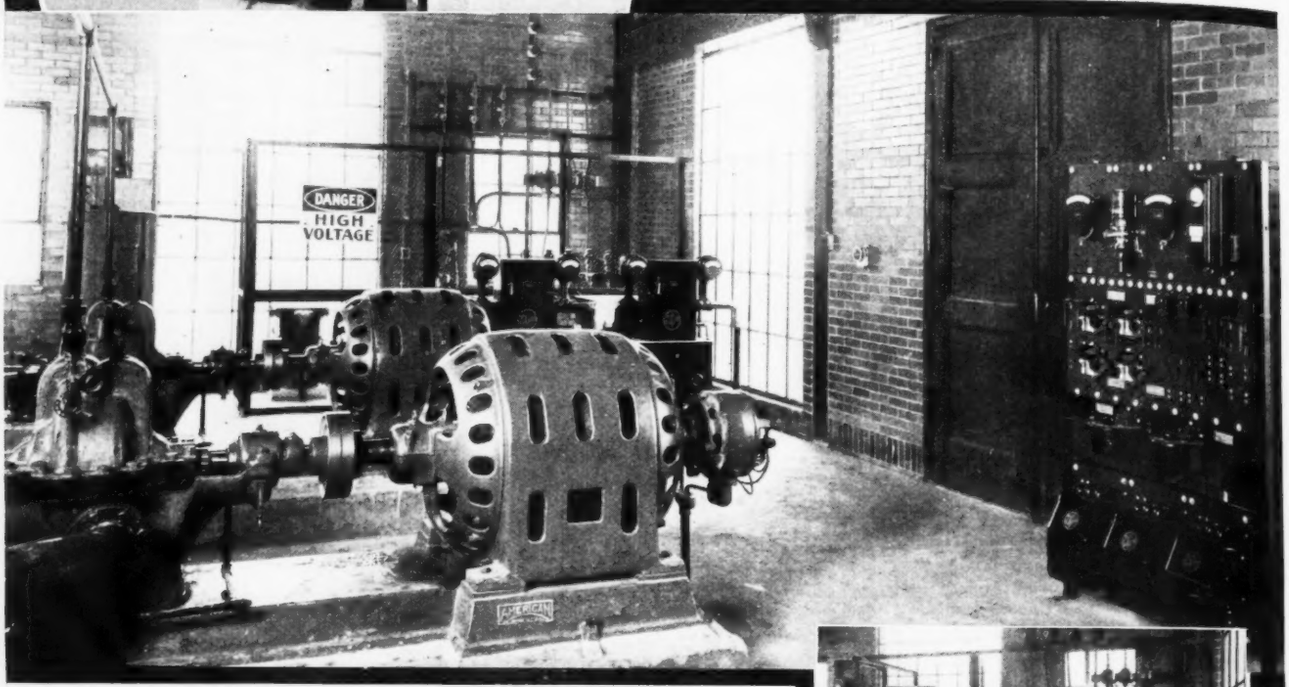

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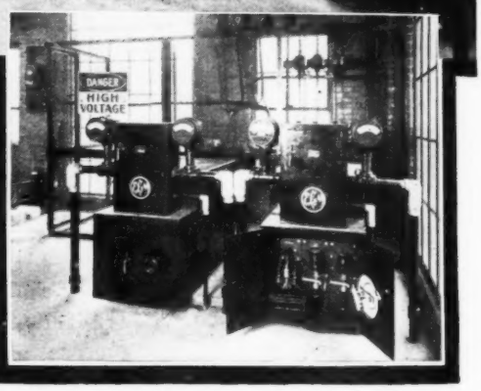

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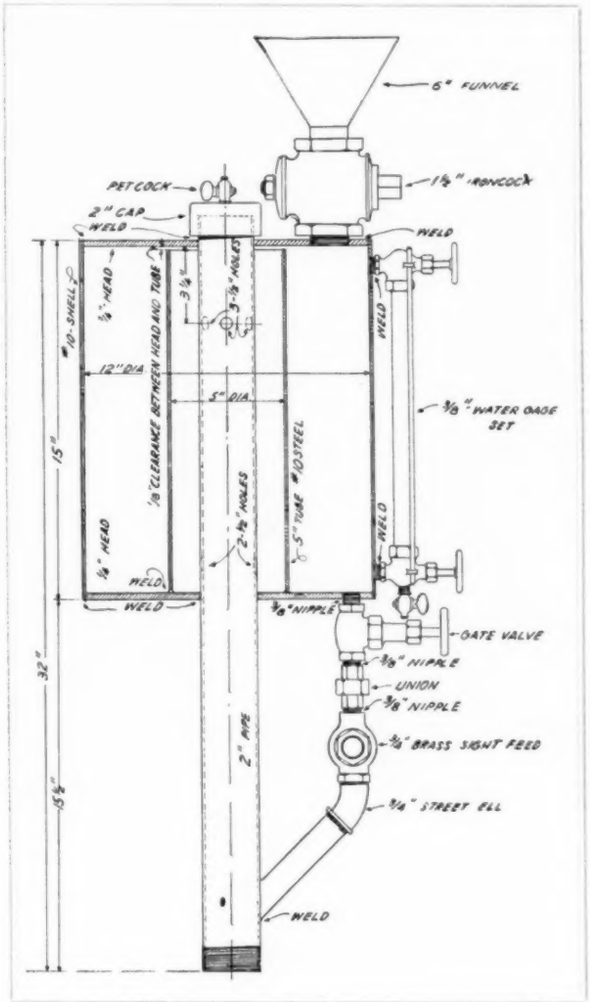
PRACTICES *and* METHODS *of* EMULSION TREATING

By HENRY ADAMS*

ANY operation necessary and incident to the preparation of crude petroleum for pipe line requirements, unless it occurs as such in a natural state, is a treating expense. Similar to other auxiliary phases of the oil business, in that no income results from the practices and methods involved, it follows, that the only criterion sought is the minimum cost per barrel, for this unquestionably necessary evil. The treating of crude petroleum is an activity so closely allied to the producing and pipe line operation, that it affords an interesting insight into the economics of these two major divisions. It is possible, through the successful execution of a definitely defined treating policy, to reduce this treating expense to a minimum, resulting in direct savings along these lines and immeasurable indirect savings from the producing and pipe line divisions.

With these thoughts in mind, the selection and design of any treating system should have as its source, these governing factors: first, the eventual volume of oil to be treated; second, the time period over which this activity will exist; third, the ultimate cost per barrel, and finally the ratio of each of these to the other.

Generally speaking, crude petroleum emulsions are of the water-in-oil type. Accepted as being formed through the action of an emulsifying agent and force upon two or more immiscible liquids, these emulsions present problems that have as their solution such methods that involve the use of high voltage alternating current electricity; various types of chemicals; and various mechanical devices, or a combination of all or any of these in the presence or absence of heat.



Electrical Dehydration

Under the influence of a high voltage alternating current, the brines of oil field emulsions are resolved from an emulsified state into a free suspension and through the combination of the small water particles into large drops, settling and separation from the oil is effected. With the judicious use of heat the efficiency of this process is amplified.

An outstanding feature connected with this process is the continuous addition of a treating agency which is made possible by the efficient mechanical design of the treating units. The minimum responsibility for the success of this process is placed upon the operator.

The oil producing areas of California, Southern Arkansas, Western Texas and the Gulf Coastal Region of Texas and Louisiana have seen the most successful operation of this process. The extensive use of this process is evidence of its success.

Chemical Dehydration

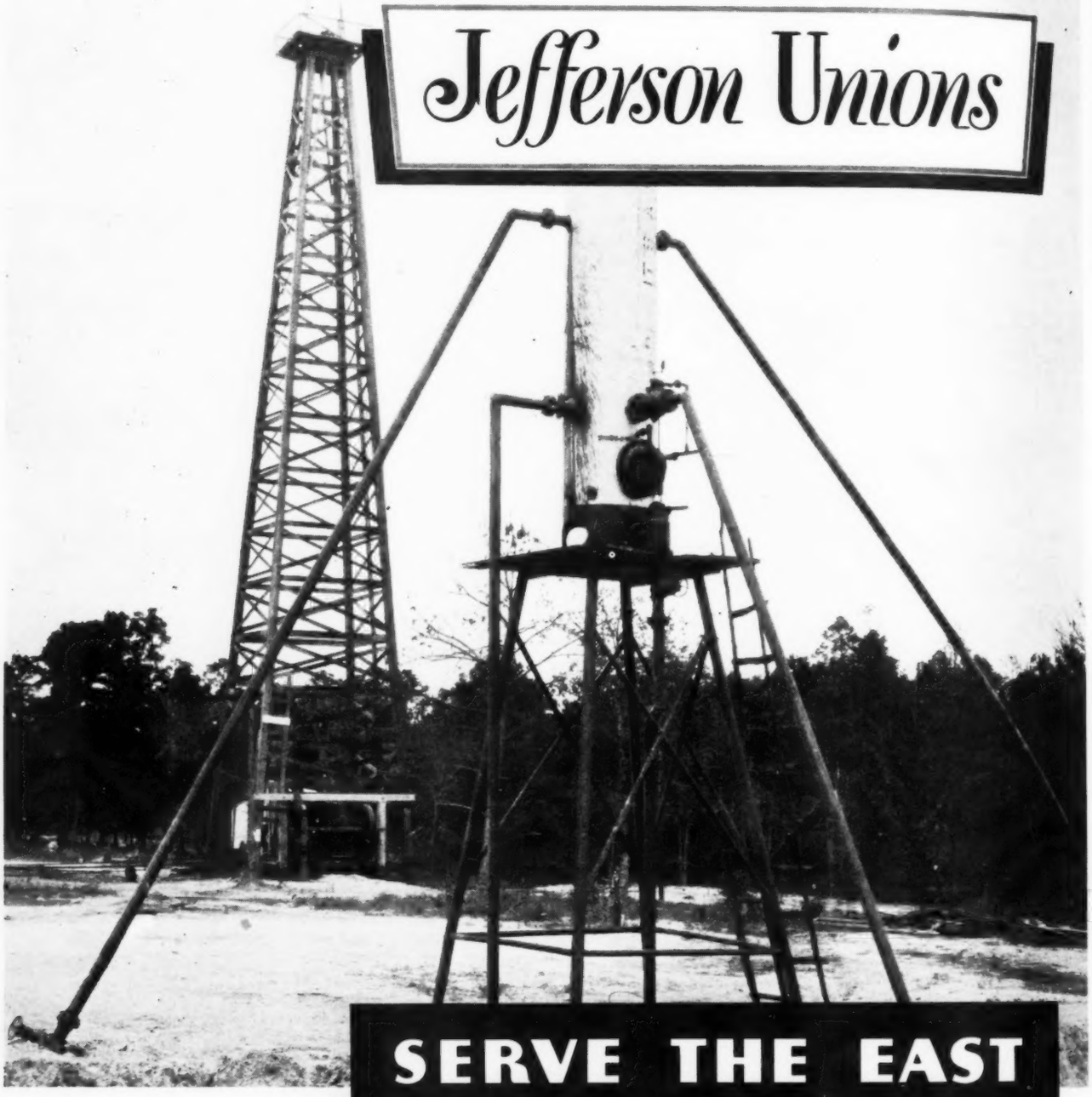
In the presence of a suitable chemical, compounded to possess demulsifying properties, the interfacial surface tension of the oil and water of petroleum emulsions lowers, and allows the water particles to separate from the oil and combine into large drops effecting almost wholly a complete separation of the two liquids. When necessary, this operation is accelerated in the presence of heat.

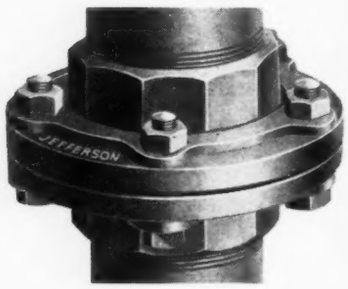
Due to the inconsistent chemical nature of both the various grades of petroleums and the accompanying brines, and in order that the use of this method be economically justified, it has been necessary to compound various types of chemicals. To the producer of petroleum emulsions, a remarkable degree of flexibility in operating is to be had as well as a minimum initial investment, in plant account, should he elect to solve his treating problems through chemical dehydration.

Chemical dehydration is used in every emulsion producing area in this country as well as identical areas in other countries. A high water-oil ratio and a high Be. gravity oil lends itself to a favorable treating condition using chemical by either the down-the-hole method or the application in flow lines or tanks. The widespread use of this method can be best explained in that, as a field becomes less productive in oil and more productive in water, treat-

*Gulf Oil Company, Houston, Texas.

Jefferson Unions





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ing costs approach a minimum and if it is necessary to use any treating agent, that agent should be purchased and distributed in the most conservative manner.

Mechanical Dehydration

There are, exclusive of those mechanical devices that have heat as the essential dehydrating agent, distinct methods by which oil and water may be resolved and separated economically without either the use of chemical or electricity and in some instances without the use of heat. They are as follows:

A. The Excelsior System.

Depending upon the physical phenomena preferential wetting, when petroleum emulsion is passed through an excelsior system, separation of oil and water occur. This system can be utilized separately on less troublesome emulsion problems, but is generally used as an aid to either electrical, chemical, or the water-knockout system to be explained below.

B. Water-Knockout System.

A system of pipes mechanically designed to provide a suitable receiving reservoir for oil and water that has not been subjected to a high degree of emulsification, constitutes this method. A small excelsior tank between the well head and the knockout system adds to the efficiency of separation.

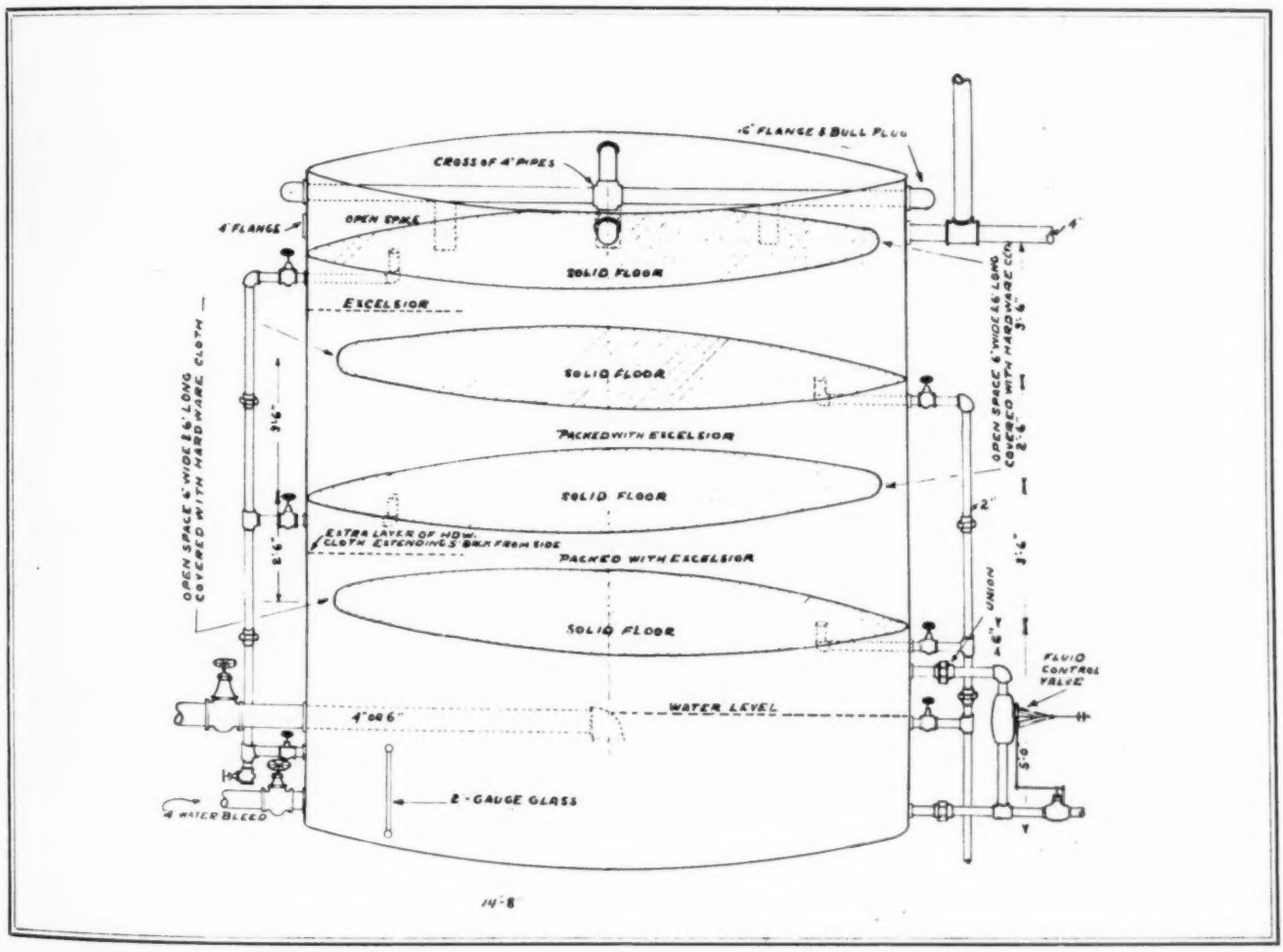
The application of these two methods depends entirely upon the producer. The ingenuity and resourcefulness necessary to the successful operation of either of these two methods is demonstrated by their use in Mexico, West Texas, California, and South Arkansas.

In the earlier days of the oil business, emulsified petroleum was reclaimed, solely by heating methods, resulting in boiling off the best constituents of the oil, settling the paraffin, and entailing unusual expense in operating. Also, tank bottom accumulation, containing valuable constituents of petroleum, were burned.

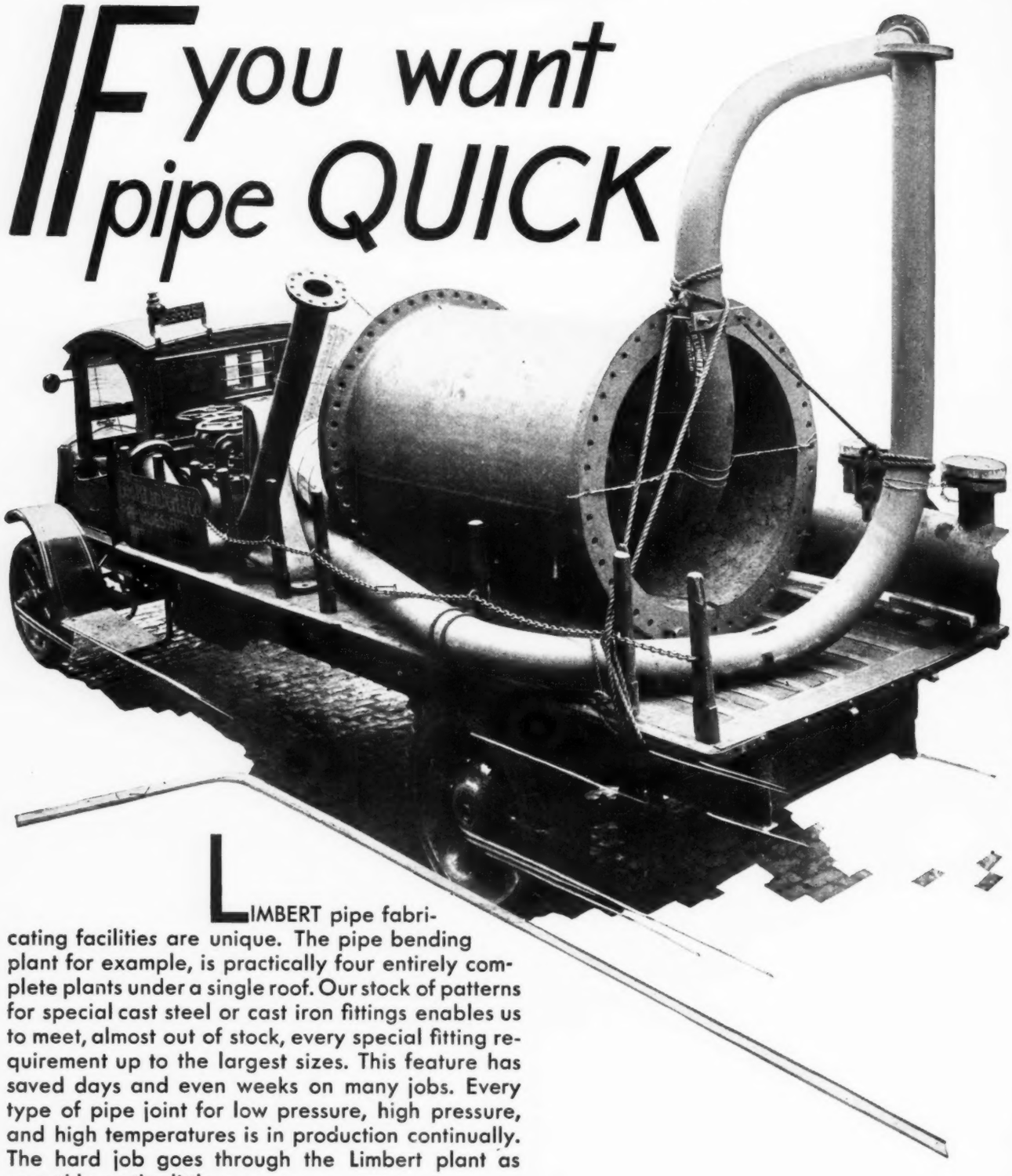
Conclusions

The actual oil content of the B. S. & W. (Basic Sediment and Water) reading will average 40 per cent. It is no longer necessary to discard this emulsified oil. The producer has the opportunity and privilege to select a scientific and economic treating method whereby oil heretofore lost can be recovered, whereby the natural well gravity of the production can be maintained through the treating procedure, and whereby the minimum B. S. & W. content oil can be delivered to the pipe line division and they in time experience lower pumping costs and less dead tank room.

Such an opportunity suggests a policy for treating operations dedicated to that method which will make the greatest contributions toward increasing the profit differential of the producing companies.



IF you want pipe QUICK



LIMBERT pipe fabricating facilities are unique. The pipe bending plant for example, is practically four entirely complete plants under a single roof. Our stock of patterns for special cast steel or cast iron fittings enables us to meet, almost out of stock, every special fitting requirement up to the largest sizes. This feature has saved days and even weeks on many jobs. Every type of pipe joint for low pressure, high pressure, and high temperatures is in production continually. The hard job goes through the Limbert plant as smoothly as the little one.

Backed by a third of a century of experience and an engineering staff with world-wide reputation, you can depend on Limbert piping to give you the highest quality of material and workmanship at a speed that will be an agreeable surprise.

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TIME *and* TROUBLE SAVERS

In rotary drilling in the Mid-Continent, where calf-wheels are seldom installed to carry the surplus wire line, care should be taken to see that the clamps used to fasten the rope for dead ending do not kink, flatten or crush the line. The use of properly designed clamps will prevent this damage.

Engine house walls are kept clean and free from oil stains by the use of the drip pan fitted with a flywheel wiper. The pan is made of light tank plate and all joints are welded. It is fitted with a slot to hold the wiper. The wiper is a piece of old belting, the upper edge of which is notched, as shown, to fit the flywheel. The piece of notched belting makes an efficient wiper, keeping the outer edges of the flywheel wiped free from oil. This is in general use by the Barnsdall Oil Co. in its central power engine houses in the Mid-Continent.

When making up sucker rod strings it is much easier to unscrew the sucker rod thread protectors than it is to knock or cut them off, but, more important, the threads will not be damaged and will permit a full, tight make-up. A tight make-up will prevent unscrewing of the string and also many breaks.

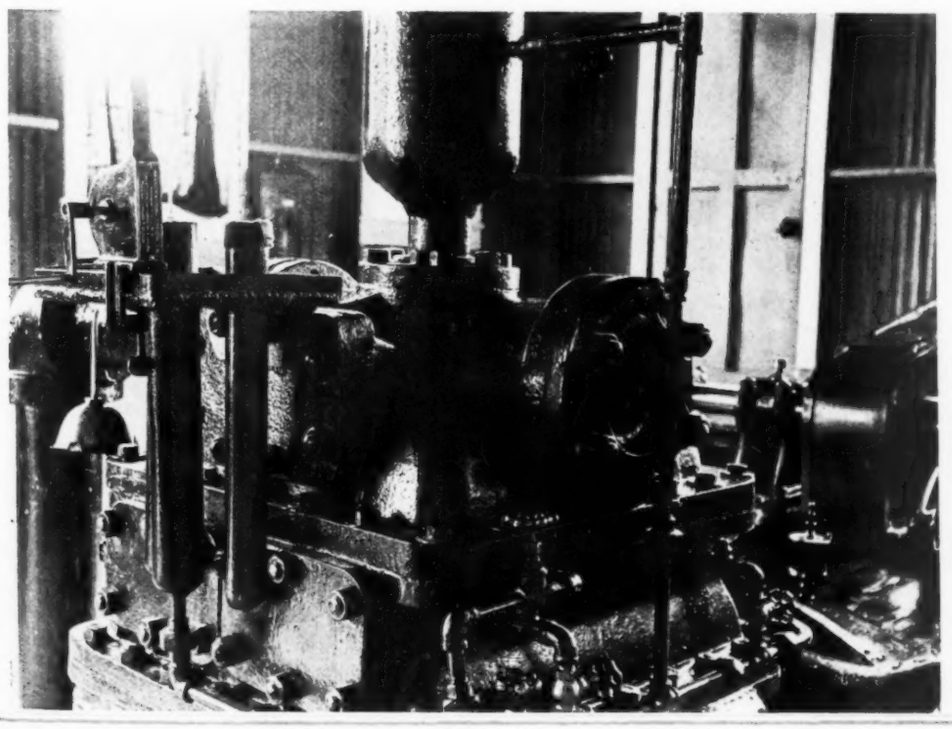
TO overcome the mess frequently connected with the routine job of sampling oil in a pipe line station and at the same time facilitate the job, F. M. Darnell, chief engineer, Stanolind Pipe Line Co., Wewoka station, designed an inexpensive device to attach to the station's suction pump. It not only proved satisfactory in the above-named respects, but also reduced the possibility of breakage of sampling and testing equipment.

Essentially it consists of three barrels made with short lengths of small-diameter pipe. Two of these are used to hold hydrometers and the other serves as a receptacle for the oil to be sampled and tested. The three barrels are welded to a frame made of boiler plate and which is welded to the pump.

A ⅜-inch line comes off the pump, as illustrated, to the oil barrel. The hydrometer holders are made with 1¼-inch pipe. These have felt in them, so when the hydrometer is inserted the oil is wiped off. The oil container is made with 2-inch pipe and is placed in the center of the device.

The hand-operated shake-out machine is attached to one side of the plate top, which has angle iron welded around its sides to prevent any oil leaking to the floor should the oil container be overflowed.

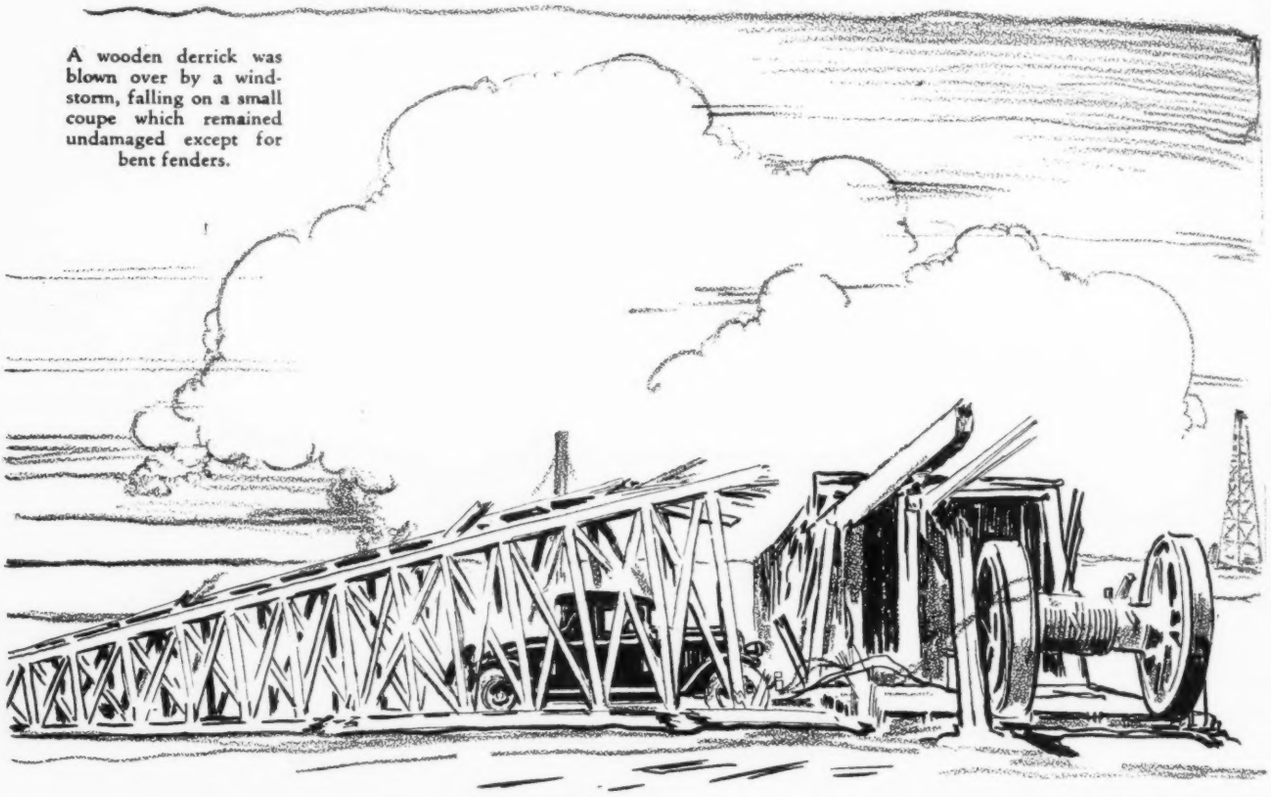
When a test and sample is desired the valve on the line from the pump is cracked, permitting the oil container to be filled slowly. After the gravity and B. S. tests are made, the oil is drained into the sump when the valve on the sump line is opened.



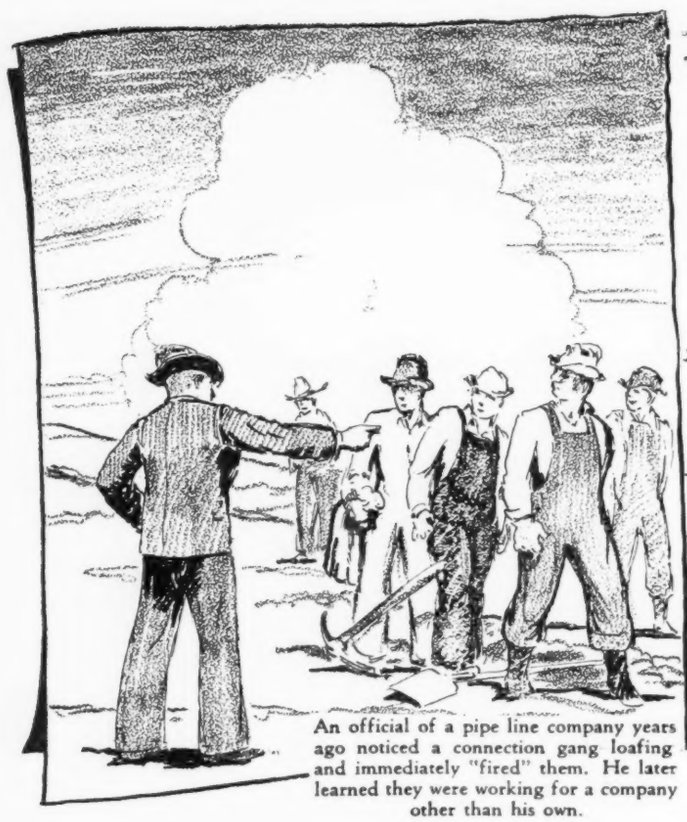
Oil sampling and testing device on suction pump.

Strange but True...

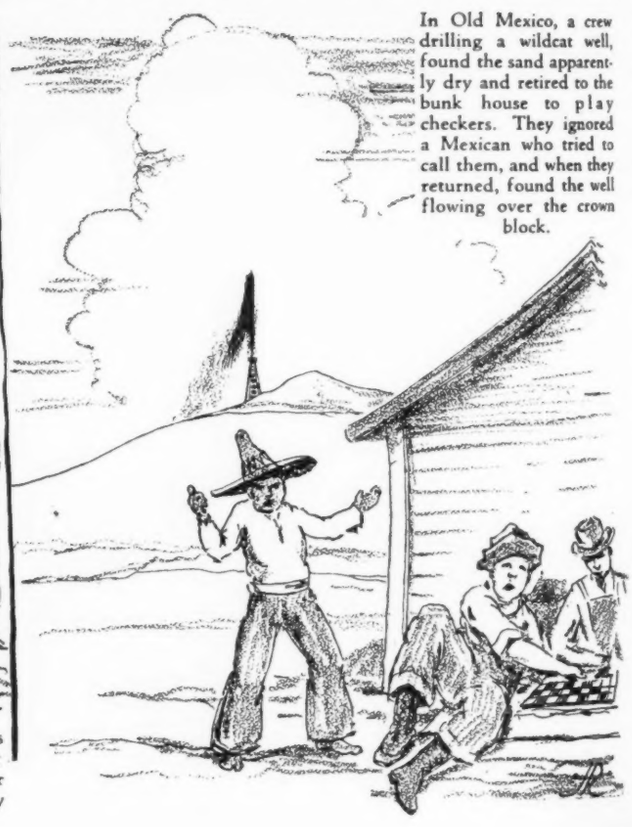
HAPPENINGS IN THE PETROLEUM INDUSTRY



A wooden derrick was blown over by a windstorm, falling on a small coupe which remained undamaged except for bent fenders.



An official of a pipe line company years ago noticed a connection gang loafing and immediately "fired" them. He later learned they were working for a company other than his own.



In Old Mexico, a crew drilling a wildcat well, found the sand apparently dry and retired to the bunk house to play checkers. They ignored a Mexican who tried to call them, and when they returned, found the well flowing over the crown block.

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Fast Time Made in

Above — Stringing 12-inch pipe.

At Right — Regulator and metering station in Big Lake field.

OLD RECORDS in pipe line construction are constantly falling as construction organizations utilize modern equipment to a better advantage and set up their field organizations to function with a minimum of delays. As these new records are attained an effort is invariably made to improve the quality of workmanship and establish new speeds. For the most part, however, new construction records hinge around the individual work of well organized crews. Over the stretch of a large job there are usually many time-consuming delays to retard progress.

When the Trojan Engineering Corporation was given 75 days to build the West Coast Power Company's West Texas system, comprising approximately 120 miles of 12 and 8-inch line, the contractors set out to establish a record. As a result of accelerated effort the job was completed 40 days after the first gang was started—21 days ahead of the scheduled completion date.

The gas system consisted of two lines built from the Big Lake field in Regan County, Texas. The 77-mile 12-inch line extends from Big Lake to San Angelo, Texas, and the 43-mile, 8-inch line runs from the same field to Girvin, Texas, terminating at an electric generating plant there.

At Left—Wm. G. Van Arsdale, superintendent of construction for Trojan Engineering Corp.

Except for a few miles all of the pipe was lapweld seamless, 40-foot lengths, and coupled with sleeve couplings. A small percentage of the total mileage was welded. Except for approximately 13 per cent of the right-of-way all of the ditching was done with machines. For the most part, the line traversed ranches and the country was easy digging for the ditching machines.

Survey parties started in the field early in January and completed their field work 20 days later. The right-of-way buyers started their work about the middle of the same month and completed it March 10. In the meantime W. G. Van Arsdale, construction superintendent for the Trojan Corporation, started organization work for the construction job. With the preliminary work cleared away, construction headquarters were opened in San Angelo, Texas, March 1.

Two weeks later the first crew began blowing rock in the hills west of Concho and one of the three ditching machines started toward Big Lake from San Angelo. Five spreads were used to build the lines, including one small crew working in the city limits of San Angelo. Two pipe gangs and one rock gang worked on the 12-inch line while one spread completed the smaller line. Each crew used three tractors, a ditcher and back-filler while the rock gang was aided with a heavy duty power shovel.

The first shipments of pipe arrived March 18 and the following day stringing crews started stringing the 8-inch with trucks and trailers. The large pipe started to arrive on March 22 and laying commenced the following day. The

Building Gas Pipe Line in West Texas

12-inch line was completed April 17 and the "golden ring" was bolted in on the 8-inch line April 24.

By having the rock gang blasting a trench through the rocky country long before the arrival of the laying gang considerable time was saved. While the rock section only totaled 13 per cent of the right-of-way, or 15½ miles, 20 tons of dynamite were used in shattering the rock.

Cleaning the trench in this section was done mostly with the power shovel, working some distance behind the shooting crew. Shovel gangs also were used. Shot holes were drilled with air drills operating from the air tanks located on the portable gasoline-engine-driven air compressors. Dull drill steel was taken to the blacksmith shops at the end of each day for sharpening.

The machines cut a 36-inch trench for the 8-inch line and a 42 to 48-inch trench for the 12-inch. In some sections the machine was remarkably fast with a record of 16,060 feet cut during one 24-hour period. On the first 12-hour shift the operator cut 8,000 feet and, on the second, the relief operator made 8,060 feet. Aided by a good start on the laying gang, the ditchers never once tied up gangs working behind them and all three ditchers finished close together, about three days ahead of the pipe crews.

On the 8-inch line, Cy Harris, spread foreman, with a crew of 90 men, laid 6.2 miles in one 12-hour day. This included stabbing, line-up, coupling, painting, lowering and backfilling. Covering the same phases of construction, A. D. Amsey, foreman, with 75 men in his crew on the 12-inch, laid 4.3 miles.

Stringing offered no unusual difficulties except in the rock country. In the remaining territory trucks with trailers rolled speedily over the flat country. Two trucks were used to string pipe in the rocky country. One was equipped with a gin pole and, as a truck and trailer of pipe arrived, it moved alongside, unloading the pipe to prevent its being damaged by the rocks when rolled off the truck and trailer.

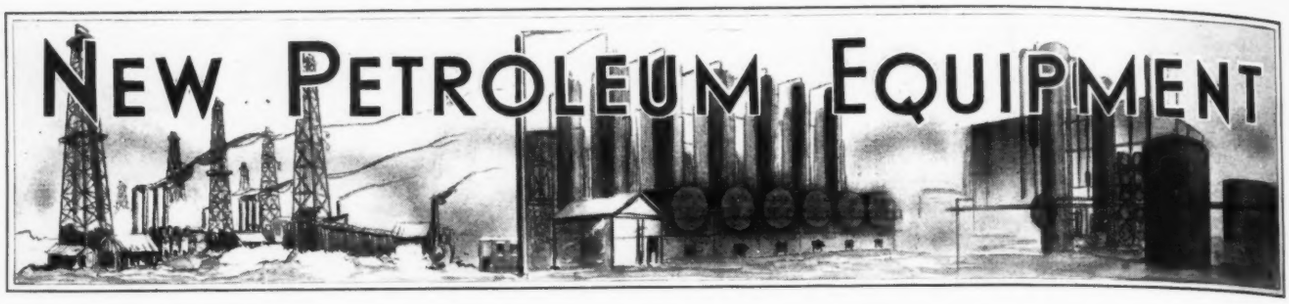
While the crews did not have heavy underbrush to contend with they did have numerous fence lines to watch.

Gate valves were installed every eight or nine miles and when the line was ready for its test it was cut in sections just ahead of the valves. Well pressure from the field was used to build up pressure for the test. As a section passed its test the gate was opened and the line blown to purge it of air and dust. All of the gate valves on the main lines are equipped with bleeders. A 3-inch riser extends upward from the pipe on either side of the valve. A 3-inch screw gate is installed and above this is a 3 by 1 swage nipple on which is a 1-inch stop cock with a plug. If pressure makes it difficult to open a gate some of the pressure may be relieved by opening the bleeder line.

Construction work also included the building of a regulator and measuring station in the field and the city border and regulator stations. Gas is delivered to the pipe line company by the two natural gasoline plants located in the heart of the field. It is sweet gas produced by the 8,500-foot wells in Big Lake.

At Left — Bolting in the "golden ring" to couple in the last section of the line. Below—Stabbing 40-ft., 8-inch joints.

Bottom—Section of 12-inch cutting through rough country.

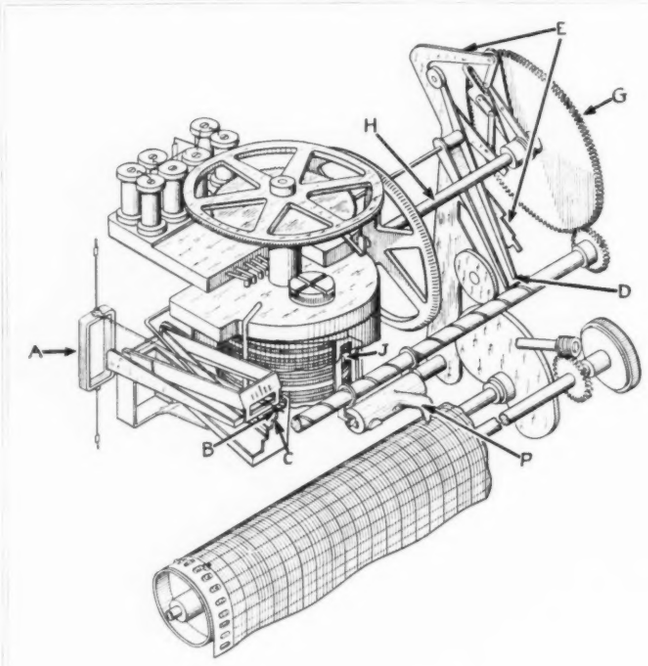


New Brown Potentiometer Pyrometer

*THOMAS R. HARRISON

THE Brown Instrument Company, Philadelphia, Pa., is placing on the market a new null type Potentiometer Pyrometer, which will indicate, record and automatically control temperature with extreme precision. The prime object in the development of this instrument was to produce an extremely accurate pyrometer to meet the requirements in modern industrial practice and sufficiently rugged to withstand the severe service conditions met with in industry.

The Brown Potentiometer Pyrometer incorporates some 53 features new to Potentiometer Pyrometers, including a positive driving mechanism controlled by the galvanometer and exerting minimum force on the galvanometer pointer and a long 40-inch slide wire enclosed in glass and which can be immersed in oil where desired for protection from corrosive gases and vapors. Another improvement is an automatic compensator which corrects the pen position for expansion and contraction of the chart paper with change in humidity of the atmosphere. The oblong holes in a strip chart are necessary to permit of this expansion and contraction with change in humidity and this movement of the chart can cause an error of as much as 1 per cent of full scale value if not corrected for.



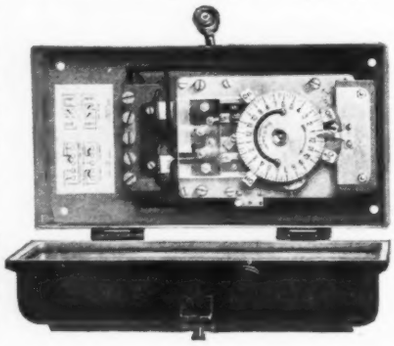
Automatic Temperature Control is obtained through mercury switches which can handle up to 25 amperes directly, without the use of relays. The case has been so designed that the instrument can be mounted on a wall, on a table, or either front-of-board or flush mounted on a panel board. These few examples of the more than 50 new features of the Brown Potentiometer indicate the care that has been taken in the design of this new instrument for accurate measurements under severe service conditions.

*Director of Research, The Brown Instrument Co., Philadelphia, Pa.

Sauter Electric Time Switch

AN electric time switch designed specifically for all time switch operations is being marketed by R. W. Cramer & Co., Inc., 67 Irving Place, New York, N. Y.

Minimum wear from the intermittent duty the clock performs at switching time is assured by the use of substantial oversized precision cut gears and hardened alloy tool steel pinions. The clock spring, which is automatically wound once a day, has a reserve power of three to four days. An ingenius clutch device prevents the over-winding of the clock spring. The 7-jewel escapement has an Invar balance wheel and Breguet hairspring. The entire escapement is easily interchangeable as a unit.



A small induction motor is used and comprises a complex unit with its reduction gears. The field can be connected in parallel or in series by means of jumpers for operation on 100-120 or 200-240 volts a. c. circuits. The motor consumes about six watts. An important feature of this system is that the motor is on the line only 25 seconds every 24 hours to fully wind the clock spring.

A quick-acting, toggle-operated, brush type switch unit with arching tips is used. It cannot reverse the operating program. This switch has a wiping contact feature and is securely locked in its closed position. It is a double-pole switch which, by means of a simple jumper arrangement on the terminal block, can be converted into a single-pole switch of 25 ampere capacity on 115-230 volts.

Imperial Sucker Rod Elevator

THE Oil Well Supply Company announces the development of the Imperial Sucker Rod Elevator, designed to carry the longest string of rods. There are few parts in the assembly and all are easily accessible, the manufacturers state.

Convenience of operation is the outstanding feature of this elevator. After stabbing, rods cannot be released except at the will of the operator. No extra motion is needed to release the latch—simply squeeze the handle and disengage the elevator. Protection for the operator's hand as well as a thumb brace have been provided.

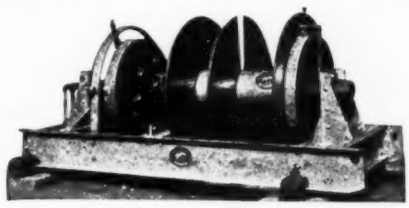
The elevator is made in two sizes: ⅝-inch by ¾-inch and ¾-inch by ⅞-inch. All parts for both sizes are interchangeable except the finished body.

The elevator is made of heat-treated, hardened steel; is light and easily handled. It is reversible, and both faces are flat so that it will rest firmly on tubing tee or guide. There is but one working part, with no plates, screws or triggers. It will easily engage from either vertical or horizontal position and disengaged with a slight pull toward the operator.

The Oil Well Supply Company, Oil City, Pa., will furnish descriptive folder No. 433 on request.

International-Stacey Reversible Jackshaft

THE new Ideco Reversible Jackshaft is announced by The International-Stacey Corporation for driving, drilling and pumping rigs and other items of machinery. It is designed for use with internal combustion engines or any non-reversible engine or electric motor.



Power is transmitted to the shaft through two internal expanding band type self-energizing friction clutches, one operating the forward and the other the reverse pulleys. The clutch drums are mounted on straight roller bearings using hardened inner and outer races. Pulley rims of various sizes may be fastened to the forward and reverse clutches. Both clutches cannot be engaged at the same time but they may be disengaged simultaneously. Two belts are used, a straight belt on the forward pulley and a crossed belt on the reverse, both belts being driven from a double crowned pulley or by separate pulleys mounted side by side on the engine shaft.

A brake mounted on the jackshaft is provided for stopping the crank to facilitate attaching or removing the counterbalance or pitman and for convenience in pulling rods, swabbing, cleaning out or in drilling operations.

A. P. I. shafting is used. Split drive sprockets for operating the chain wheel and a chain driven sand reel are keyed to the shaft between the forward clutch and the bearing. A sand reel clutch and sprocket may also be attached to the end of the shaft.

The shaft is mounted in self-aligning roller bearing pillow blocks. Heavy duty straight roller bearings are provided. Babbitted bearings can be furnished upon specification.

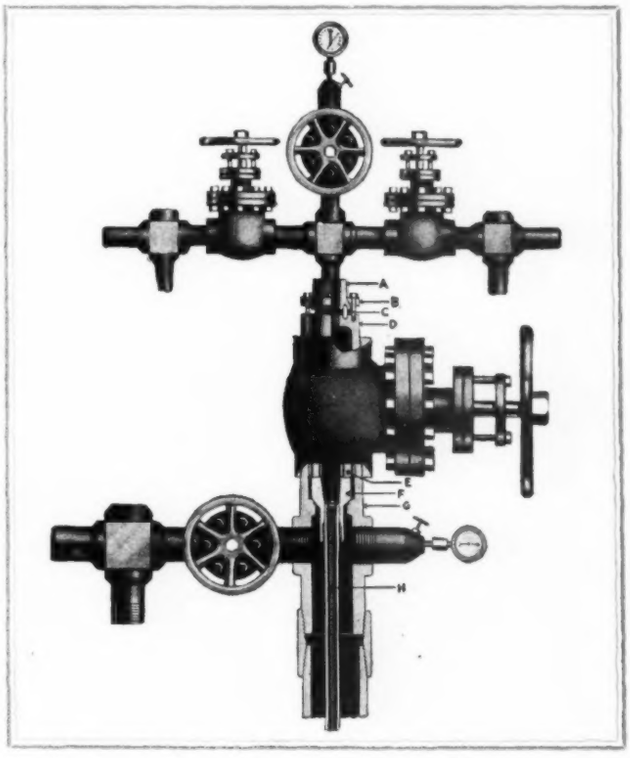
Positive lubrication is obtained through the use of the Alemite pressure lubrication system.

O-C-T Full Control Tubing Head

OIL CENTER TOOL COMPANY, INC., Houston, Texas, is making a new full control head that permits the master gate valve to be closed at any time against pressure with tubing in the hole, without making any adjustments on the head. This O-C-T tubing head consists of a swivel connection unit screwed into the top of the master gate, a main body, and a tubing hanger which seats in the main body.

Features of the unit are that the master gate may be closed against pressure with the tubing in the hole without making any adjustments to the head. The tubing hanger seats on a steel-to-steel ground joint, there being no packing to replace or to burn out in case of fire. The top swivel connection unit is to allow the Christmas tree to be swiveled so the flow lines will point in any desired direction. To swivel the Christmas tree the bolts in the top swivel connections are loosened. Or, in the event it is desired to remove the Christmas tree it may be lifted completely off, without disturbing any pipe connections, by removing the bolts which hold the swivel connection together.

The O-C-T full control tubing head was designed for either flowing or pumping wells. When it becomes necessary to pump a well, the master gate may be removed and a regular coupling screwed between the main body of the head and the top swivel connection.



Lufkin "Crescent" Tape-Rule

A SIX-FOOT measure, combining in a unique way the convenience of a pocket tape and the utility of a rule, has just been brought out by The Lufkin Rule Co., Saginaw, Michigan, manufacturers of Measuring Tapes, Rules and Precision Tools. It is known as the "Crescent" Tape-Rule. It is an accurate steel tape that automatically winds into a sturdy case only two inches in diameter, yet, when withdrawn is rigid like a rule. No. 696 is marked inches to 16ths; No. 696D is marked feet, 10ths and 100ths of feet, i. e., engineers' measure.

The line or rule blade is of a super quality tempered steel, stiffened by special forming. It is nickel-plated and has prominent dark markings. Unsupported, it may be projected like a rule. It will also flex around and accurately measure circular, round-cornered and other shaped objects. Measurement is taken when outer end is projected against any object, and the solid clip at first end serves for withdrawing rule blade from case and also as a hook for taking measurements out of arms reach. The case is chromium-plated, and has smooth working, spring-winding device with ratchet stop.

The Lufkin "Crescent" Tape-Rule is sold at hardware and tool stores, engineering supply and factory supply houses.

Byron Jackson Tubing Catcher

A NEW tubing catcher, distinctive in many points of construction, is now being sold by Byron Jackson Co., under the name of "BJ Surestop Tubing Catcher."

This catcher consists of only ten parts, with no small bolts, nuts or cotter pins to become easily lost or damaged. The entire tool is of rugged construction and easy to assemble.

The over-all length of the "Surestop" has been held to a minimum to facilitate running operations and numerous tests have shown that, even in crooked holes, there is no tendency to catch or hang-up while running in at top speed. Unusually large circulation passages further increase the running-in speed.

The three slips are of special heat-treated steel and they have a very large area. The extra width of these slips, together with the angle of the teeth, insures catching and holding in a drop not to exceed 2½ inches.

A strong guide collar, located near the top of the catcher, prevents any possibility of the slips passing over the head of the catcher.

Illustrated literature describing the BJ Surestop Tubing Catcher will be forwarded upon request by Byron Jackson Co., 2150 Slauson Ave., Los Angeles, Calif.

Shaffer Tool Works Adds to Their Line of Fishing Tools

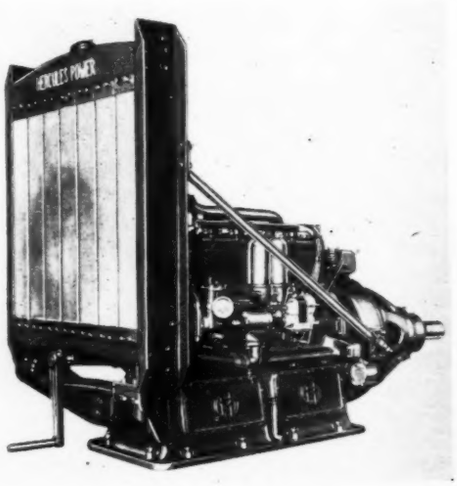
SHAFFER TOOL WORKS, Brea, California, announces the new Shaffer Inside Casing Cutter. The makers claim that it is a proven tool which is rapidly coming into favor among the oil fraternity because of its ruggedness and simplicity. The cutters are actuated by pressure from the mud pump and the design permits cuts to be made in either direction. The knives automatically collapse when the pressure is relieved. The very simple and effective arrangement of parts positively indicates when a cut has been made. The knives are exceptionally strong—3-inch being used on the smaller sizes and 5-inch on the larger ones. The design is such that even the 3-inch size is adequately strong and simple to operate. This tool gives excellent results when used for breaking up or reaming out the cement wall or formation below the casing shoe.

The construction of this tool is ideal for foreign trade as there are no tricky parts. Cutters are the only extra parts needed.

Hercules Develops "HX" Series of Power Units

FOR oil field service, the Hercules Motors Corporation of Canton, Ohio, has developed an additional line of power units built around the heavy-duty "HX" Series of six-cylinder engines. The "HX" Power Units are built in five different sizes: the HXA, 4¾"x6", displacement 638 cu. in.; the HXB, 5"x6", displacement 707 cu. in.; the HXC, 5¼"x6", displacement 779 cu. in.; the HXD, 5½"x6", displacement 855 cu. in.; and the HXE, 5¾"x6", displacement 935 cu. in.

All "HX" Power Units in the standard assembly include a radiator of ample proportions to insure proper cooling; a clutch power take-off; and all necessary engine accessories. A control box located on the opposite end from the



radiator provides for convenient regulation of carburetor and magneto. The radiator frame is strongly braced, making the whole assembly exceptionally rigid.

While designed to operate on gasoline, "HX" Series Power Units can be arranged for operation on natural gas or kerosene. Reduction gears are also available as optional equipment.

The "HX" Series Power Units meet a definite need for engines in the higher horsepower ranges and have aroused considerable interest among all field operators.

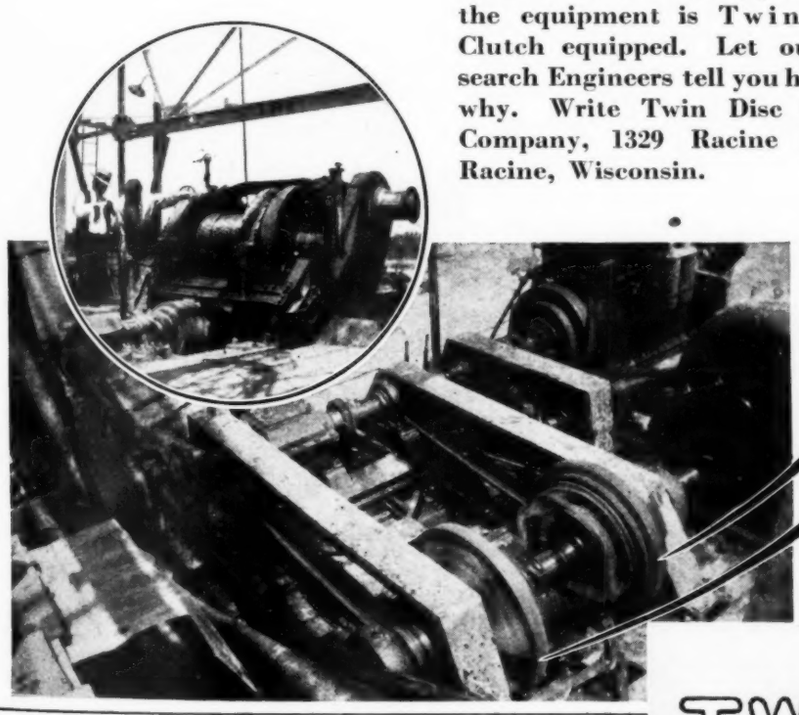
NEW HOOK-UP MAKES REMARKABLE RECORD

At Rio Bravo No. 1, near Reynosa, Northern Mexico, this Type "H" Sheldon-Burden Drilling Machine with its new type double engine hook-up and reverse unit, is making a remarkable record. Working steadily for two and one-half months *without shutdowns* it has reached a depth of 3500 feet in spite of difficult formations.

Two diesels ... each with Twin Disc Clutch, No. 7475, supply the power. The drilling machine has 3 rotating speeds and six hoisting speeds. One diesel operates it; the other drives two mud pumps. Coupled to the drive of the two diesels is a forward and reverse clutch unit ... with two Twin Disc Clutches ... giving unusual flexibility in drilling. The diesels are so placed that the two Twin Disc Clutches run in opposed directions. The drilling motor furnishes the forward speed; the pump motor, the reverse. By means of a clutch in a gear box, the power of both motors can be used for hoisting. Either engine can take up the duties of the other or one engine alone can operate the entire unit.

This remarkable interchangeability of power practically assures constant drilling. And the hook-up is as economical as it is efficient, using but 4 barrels of fuel oil in 24 hours.

Wherever new successes are being scored in the oil fields, you'll find the equipment is Twin Disc Clutch equipped. Let our Research Engineers tell you how and why. Write Twin Disc Clutch Company, 1329 Racine Street, Racine, Wisconsin.



PARTS STATIONS

Boston—Rapp Huckins Co., Inc., 138 Beverly St.
Buffalo—Edward W. Rode, 45 A St.
Cleveland—Industrial Engine Parts Inc., 1053 E. 61st St.
Chicago—Motive Parts Co. of Am., Inc., 2419 Indiana Ave.
Western Contractors Supply Co. 14 North Clinton St.
Detroit—Whitney Brothers, 6464 Epworth Blvd.
Fort Worth—Fort Worth Wheel & Rim Co., 312 Throckmorton.
Knoxville—Automotive Equipment & Supply Co.
Houston—Portable Rig Co., Inc.
Los Angeles—Coast Mach. Corp., 931 Sante Fe.
New York City—John Reiner & Co. Inc., 290 Hudson St. at Spring.
Philadelphia—Maerky Machine Works, 632 Race St.
Pittsburgh—Contractors Eq. Service Co., 519 E. Gen. Robinson St., N. S.
Portland, Ore.—Clyde Equipment Co. 555 Thurman St.
Richmond—Standard Parts Corp., 1806 W. Broad St.
San Francisco—F. Somers Peterson Co., 57 California St.
Seattle—Clyde Equipment Co., 3410 First Ave. So.
St. Louis—Climax-Jones & Quinn, 3124 Locust Blvd.
Tulsa—Buda Engine Service Co. of Tulsa, Inc.

TWIN DISC CLUTCHES

When writing TWIN DISC CLUTCH CO. *please mention The Petroleum Engineer*

Crestoloy Steel Wrenches

CRESTOLOY is the trade-marked name of a new steel developed by the Crescent Tool Company's Experimental Department in conjunction with other metallurgists after three years' experimental work. This steel has the properties of great strength and toughness and the first tool to be made of it is the Crestoloy wrench.

These new wrenches will stand a strain of over twice that required to break a regular Crescent Wrench, according to the manufacturers, yet they are one-third thinner, much lighter, easier to handle and have a wider range of usefulness.

Further details of this new steel wrench can be obtained from the Crescent Tool Company by writing it at Jamestown, N. Y.

Tag Hydrometer

SINCE simplicity of construction makes for a more rugged instrument and consequently less likelihood of breakage, C. J. Tagliabure Mfg. Co., of Brooklyn, N. Y., has designed a hydrometer with a streamline tip. It has no corners to collect dirt and it will not be pulled out of your hand in wiping.

Instead of a mercury ballast, a low melting point alloy in a solid piece has been firmly fastened in the bottom of the instrument so that it cannot come loose even when the hydrometer is inverted.

The usual high standard of accuracy of Tag Hydrometers is maintained in this new instrument and the simplicity of design has made possible a large saving in price, the manufacturers state.

Oil Well Lone Star Boiler No. 1008

THE Oil Well Supply Company, Oil City, Pa., has introduced a new lightweight boiler identified as the Oil Well Lone Star Boiler No. 1008. The boiler is built for 250 pounds' working pressure and has a rating of 100-105 horsepower. It is compact in design with an overall length of 19 feet 8 inches, a firebox 84 inches long and weighs only 11½ tons.

A full open bottom firebox with solid steel mud ring, permits the use of larger gas burners, and also provides for over 155 cubic feet of combustion space. One hundred fifty-six seamless steel tubes are arranged in vertical rows with four washout plugs installed in the back of the tubes at the smokebox end. This facilitates washing the inner tubes from all angles and gives access to tubes that otherwise could not be reached.

The Lone Star Boiler is regularly furnished with tubes welded in the firebox end. A surface blow-off is standard equipment and consists of a copper funnel with the mouth at the water level. Impurities floating on the surface of the water are carried into the mouth of the funnel. A Thermic Syphon is optional. Folder No. 435 is available upon request from the Oil Well Supply Company.

Neilan Differential Limit Controller

NEILAN CO., LTD., manufacturers of automatic control and regulating equipment, are marketing a recently perfected differential or pressure limit controller. This automatic device serves in a large number of services such as cutting in and out additional measuring meters whenever distribution loads build up periodically and later fall back to normal. It also closes a valve in long transmission lines in the event of a line break which would otherwise be both dangerous and costly. It automatically starts and stops booster pumps as the line pressures vary under different load conditions.

This controller is entirely self-contained, simple in design and rugged in construction. A full description may be obtained in a new booklet being distributed by Neilan Co., Ltd., 641-651 Santa Fe Ave., Los Angeles, Cal.

Gauge Protector and Non-Pulsator

CHAMPION AND BARBER, INC., of 576 Subway Terminal Building, Los Angeles, announce the manufacture of two new gauge protection products—the Champion Gauge Protector and the Champion Non-Pulsator.

The Champion Gauge Protector is a simple, three part, bronze bodied, rubber bulbed pressure transmitting instrument, used to transmit line pressures to gauge recordings by means of a secondary, or bulb pressure; said recording being the result of the compression of secondary bulb liquid by a given line liquid. It has an anti-corrosive body, an acid resistant pressure bulb; restricts the passage of line solids into the gauge or tube movement.

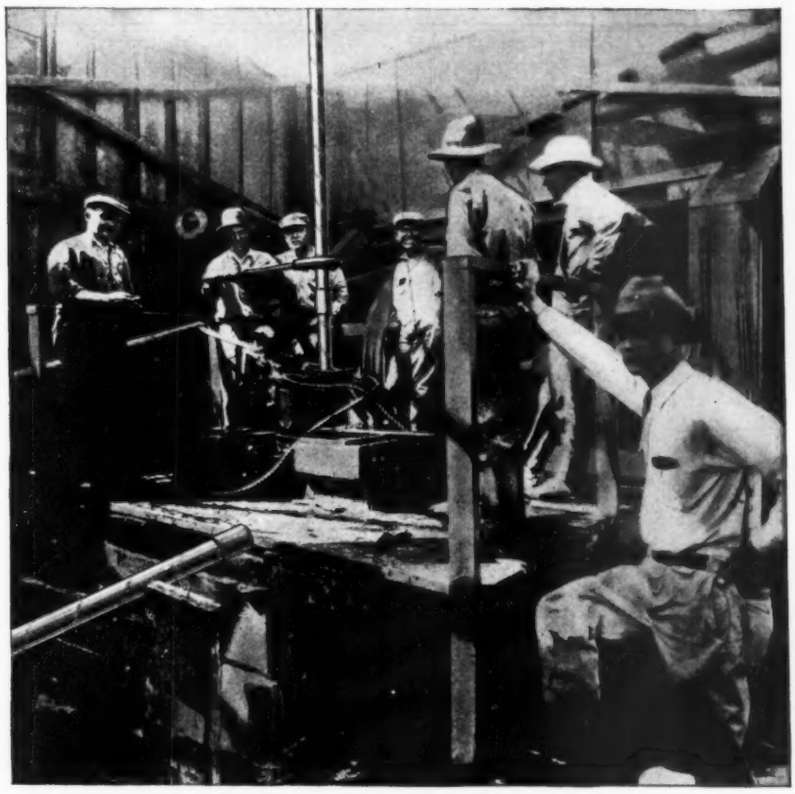
The Non-Pulsator operates by a fluid passage restriction and the control of the restriction by means of a needle valve. Or, in other words, the pulsation recordings on the gauge are controlled entirely by the adjustment of the needle valve, regardless of the pulsations of the line pressures.

More complete data may be secured by writing Champion and Barber and requesting a copy of "Gauge Protection via the Champion Method."

Williams' "Vulcan Superior" Tongs

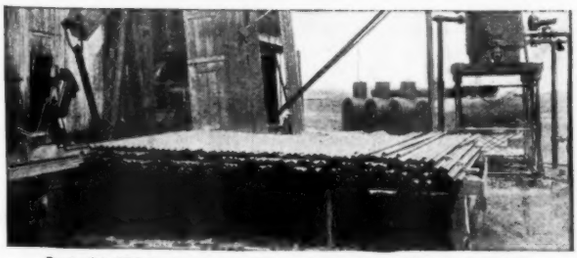
THE latest addition to J. H. Williams & Co.'s line of chain pipe tools is a universal service tong designed to handle both pipe and fittings. The jaws of the "Vulcan Superior" tongs are reversible, providing double service. A special design, incorporation of a "V" recess in the jaws assures quick and positive grip on fittings.

The tongs will take either flat chain or cable chain. Each flat chain is proof-tested and certified. Seven sizes of these tongs are available, handling pipe and fittings from one-eighth to 12 inches. Further information will gladly be furnished by the J. H. Williams & Co., 75 Spring St., New York City.



RUNNING 6,300 FEET READING WROUGHT IRON TUBING IN THE OKLAHOMA CITY POOL

Reading Tubing ready for the hole, Trosper Park Lease.



Part of 6,600 foot string of Reading Tubing. When this tubing was run, it was the longest string of Wrought Iron tubing in the world. Reading Tubing is stocked in all important fields.

WHERE STRINGS OF READING TUBING UP TO 6,600 FEET HAVE BEEN RUN

—wherever conditions are tough, investigate the possibilities of Reading Wrought Iron Tubing —permanently identified by the indented Reading Spiral on every joint.

For information and quotations address

READING IRON COMPANY
READING, PENNSYLVANIA

Atlanta, Baltimore, Boston, Buffalo, Pittsburgh, Cincinnati, New York, Detroit, Houston, St. Louis, San Francisco, Seattle, Chicago, Philadelphia, Tulsa, Los Angeles, Kansas City

Reading Pipe also distributed by:
Frick-Reid Supply Corporation, Bradford Supply Company, Republic Supply Company, Superior Tube Company, International Supply Company.
Our own stocks at Houston, Texas.

For your protection this indented spiral forever marks all Reading Pipe.

READING 5 POINT PIPE READING GENUINE PUDDLED WROUGHT IRON **PIPE**

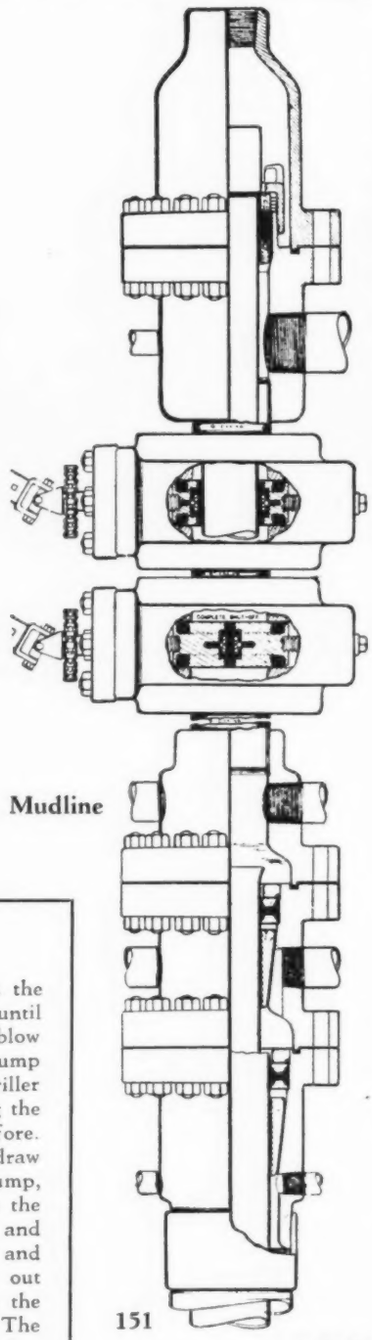
Science and Invention Have Never Found a Satisfactory Substitute for Genuine Puddled Wrought Iron.

When writing READING IRON CO., *please mention The Petroleum Engineer*

A New Shaffer High Pressure Drilling Hook-Up

Shaffer Products

Adjustable Flow Beans
Blow-Out Preventers
High-Pressure Fittings
Warren Control Heads
Richfield Type Casing Heads
Combination Casing Heads
Olinda Type Casing Heads
Midway Type Packing Heads
T. & T. Fishing Tools
Safety Releasing Sockets
Safety 3-Slip Spear
Expanding Pin Taps
Pump Trip Hydraulic Jars
Shaffer Kelly Cocks and other high grade Oil Field Specialties



The Warren Head is a blow-out preventer, of the stuffing-box type, good for normal pressures, when there is not sufficient danger to warrant closing the control gates. The Warren flanged Christmas-tree cap is shown in place, providing the fourth safety feature of this hook-up. Patent No. 1,598,794.

A pair of Shaffer Cellar Control Gates. Upper Gate provides protection around the drill pipe. Lower Gate provides protection "out of the hole" when there is no drill pipe present, and replaces the old-style drilling valve.

Shaffer Cellar Control Gates can be fitted with hand-wheel and with Shaffer universal joints, giving simple remote control from any place outside the derrick.

◆

SPOOL TYPE HEAD

With this new head the casing is set in place on slips without having to cut a nipple, after which the casing is cut off and packed. The most compact form known in which the casing can be carried on slips. Patent No. 1,589,729. Now in use at Kettleman Hills and Elwood.

Write for Detailed Information, Blue Prints, etc., concerning Shaffer Equipment.

Shaffer Fluid Trip Jar

To operate the driller lowers the drill pipe to set and pulls up until he has the desired strain. The blow is obtained by starting the pump which trips the jar. The driller then resets the jar by lowering the drill pipe and proceeds as before. Thus with one man at the draw works and another at the pump, the jar is operated as fast as the drill pipe can be raised and lowered, using only the engine and brake and without throwing out the clutch or having to use the table to set or trip the jar. The jar has come out of the hole after 75 hours jarring in perfect condition. Circulation is maintained at all times except when jar is set for tripping. The force of the blow can be varied since the jar is tripped at will by the pump. Four Controlled Blows per Minute.

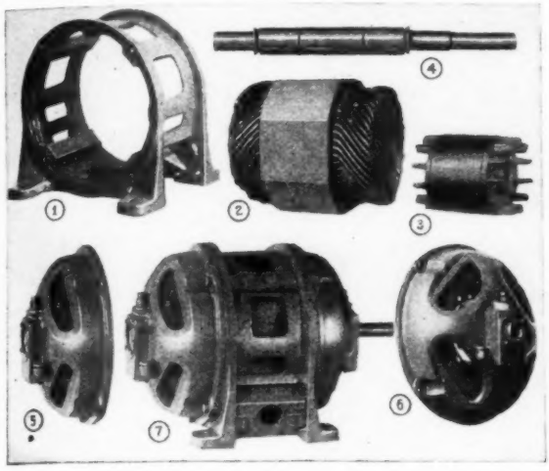
SHAFFER TOOL WORKS

BREA **Mid-Continent** **CALIFORNIA**

HOUSTON—Robt. J. Miller Co.
OKLAHOMA CITY—Fluid Packed Pump Co.
FOREIGN—Oil Well Supply Co.

Westinghouse Motor Has Entirely Separate Units

IN the design of the new Westinghouse W-frame type CS squirrel cage induction motor, the manufacturers have incorporated an important innovation in motor design; making the different parts of the motor as entirely separate units. Having adopted the separate parts idea, the company has only to keep the number of standardized parts in stock to be able to build, on short notice, a motor for a specific application. The new design makes maintenance simpler and less expensive, because damaged electrical parts can be replaced without replacing or rewinding the motor.

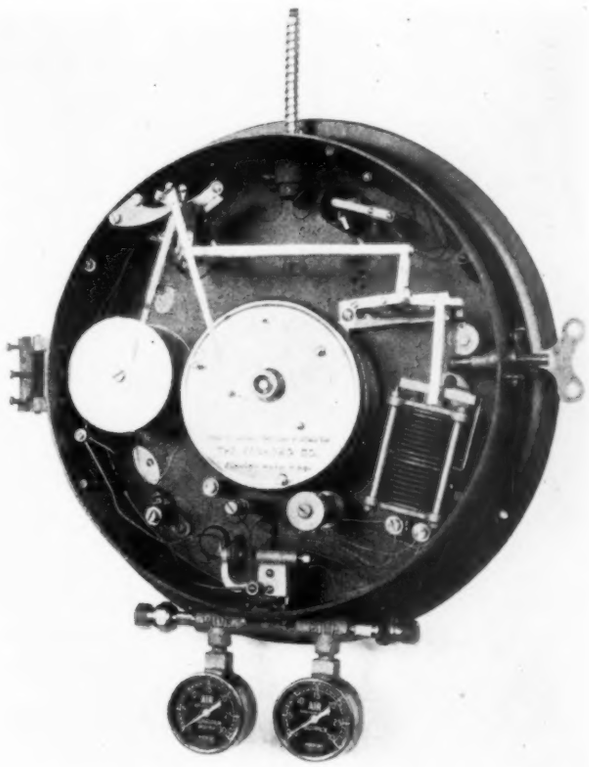


In the new induction motor the stator core containing its winding is pressed into the motor frame. When it becomes necessary to replace a damaged winding, the old core and its winding is pressed out as a unit by means of an ordinary arbor press and a new "pre-wound" core pressed in. The rotor is also a complete separate unit; and both the rotor and stato core and minding can be supplied as such for built-in motor or repair purposes.

The separate-frame construction makes it possible to supply any one of a number of different types of frames to meet the needs of the customer. The brackets are bolted to the frame with a ring-groove fit that automatically and permanently sets the air gap and aligns the bearings, simplifying reassembly.

Further details may be secured from the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Foxboro Announces Stabilizer



THE Foxboro Company of Foxboro, Mass., announces the stabilizer, the latest development in the field of automatic control.

The stabilizer is an automatic controller that has complete command of the controlling medium. Foxboro designed it for use on tops of towers, pipe stills, reboilers and scores of other industrial processes involving problems of temperature, pressure or flow.

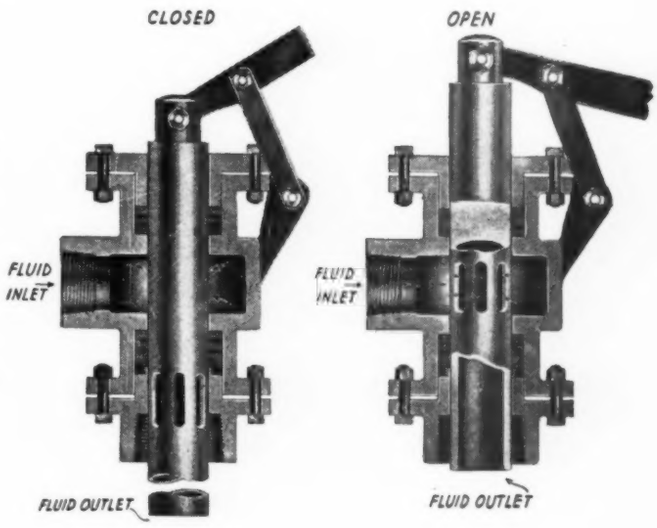
This instrument is particularly applicable to any control problem involving a complicated process lag, as it has a type of throttling range that prevents "hunting" or over-controlling. Its outstanding characteristic, however, is an automatic stabilizing feature that prevents the effect of throttling range from changing the control point.

Brauer Slush Pump Release Valve

THE Brauer Machine & Supply Company of Oklahoma City announce a new release valve for rotary slush pumps and boiler blow-off lines. The features of this valve are the hollow plunger, with fluid inlet ports operating between two stuffing boxes. This has proved to be a distinct improvement.

The pressure is equalized in the fluid chamber of the valve, and, with a lever handle, the valve is easily and quickly opened and closed under any pressure.

Further particulars may be had by writing Brauer Machine & Supply Company.



RUNNING TOUR With Men In The Industry

Myron H. Clark

Myron H. Clark has been elected vice-president in charge of operations for the Reading Iron Company. Mr. Clark has been assistant to the president of the Crucible Steel Company of America at Pittsburgh.

H. H. Hewetson has been elected vice-president in charge of manufacturing of the Standard Oil Co., of Louisiana, at Baton Rouge, La. He was formerly vice-president of the Colonial Beacon Oil Company.

A. C. Yingling, formerly superintendent of compressor station for the Cities Service Gas Company at Winfield, Kansas, is now general superintendent of the Emerald Oil Company at Fort Worth, Texas.

Lester Patrick of the Patrick Drilling Company has moved to Tyler, Texas, from Oklahoma City.

W. R. K. Scott, of the engineering department, Jones and Laughlin Steel Corporation, Pittsburgh, Pa., was a recent business visitor to the Tulsa trade territory.

H. J. Morlang, vice-president in charge of the Midwest Division, Oil Well Supply Company, Tulsa, Okla., recently spent several days at Pittsburgh, Pa., and also at the Imperial Works of the Oil Well Supply Company at Oil City, Pa.

Lester Patrick

Alfred Fisher, of London and New York City, has joined the staff of Universal Oil Products Company to carry on certain phases of research and development work. Mr. Fisher is a chemist and chemical engineer who has for years specialized in development work in connection with coal, oil and gas.

C. B. Watson

C. B. Watson, vice-president of The Pure Oil Company, was elected a director of the company to succeed the late William W. Mills at a recent meeting of the Board of Directors. Mr. Watson, in addition to being in charge of all refinery operations, supervises the company's pipe lines, crude oil purchasing, engineering and marine departments, wholesale sales and retail sales throughout the Southwest.

E. E. (Ned) Robbins has been appointed division sales manager of the Oil Well Supply Co., a subsidiary of the United States Steel Corp., and will have headquarters in Tulsa, Okla. In his new capacity he will have charge of sales in the Mid-Continent, Gulf Coast, Rocky Mountain and Canadian oil fields.

Ned Robbins

Although young in years, Mr. Robbins has enjoyed a particularly broad experience. For ten years he was associated with the McCord Radiator and Mfg. Co., handling oil field sales in the Mid-Continent and California territories. He was with the National Supply Co. at Tulsa, Okla., for one year in charge of sales of Superior Gas Engines. During the past five years he has been vice-president of the C. F. Camp Co., of Tulsa, Okla., and in this capacity he was instrumental in the advancement and development of gas engines for rotary drilling and contributed much toward the first successful application of this character in the Mid-Continent field.

Mr. Robbins, who is extremely popular and enjoys a wide acquaintance, assumed his new duties June 15th.

Paul McGivern of B. & A. Specialty Co., spent several weeks in California the latter part of May. He visited Salt Lake City and Denver before returning to Tulsa.

S. Taguchi, chief engineer, Nippon Oil Co., Marunouche, Tokyo, Japan, has been transferred to Byoritsu, Shinchika-shu, Taiwan, Japan.

L. L. Minor, Jr., general manager of sales for Spang, Chalfant & Company, Inc., of Pittsburgh, Pa., is on an extended trip to Los Angeles, San Francisco and the California oil fields, returning by way of the Southern oil districts.

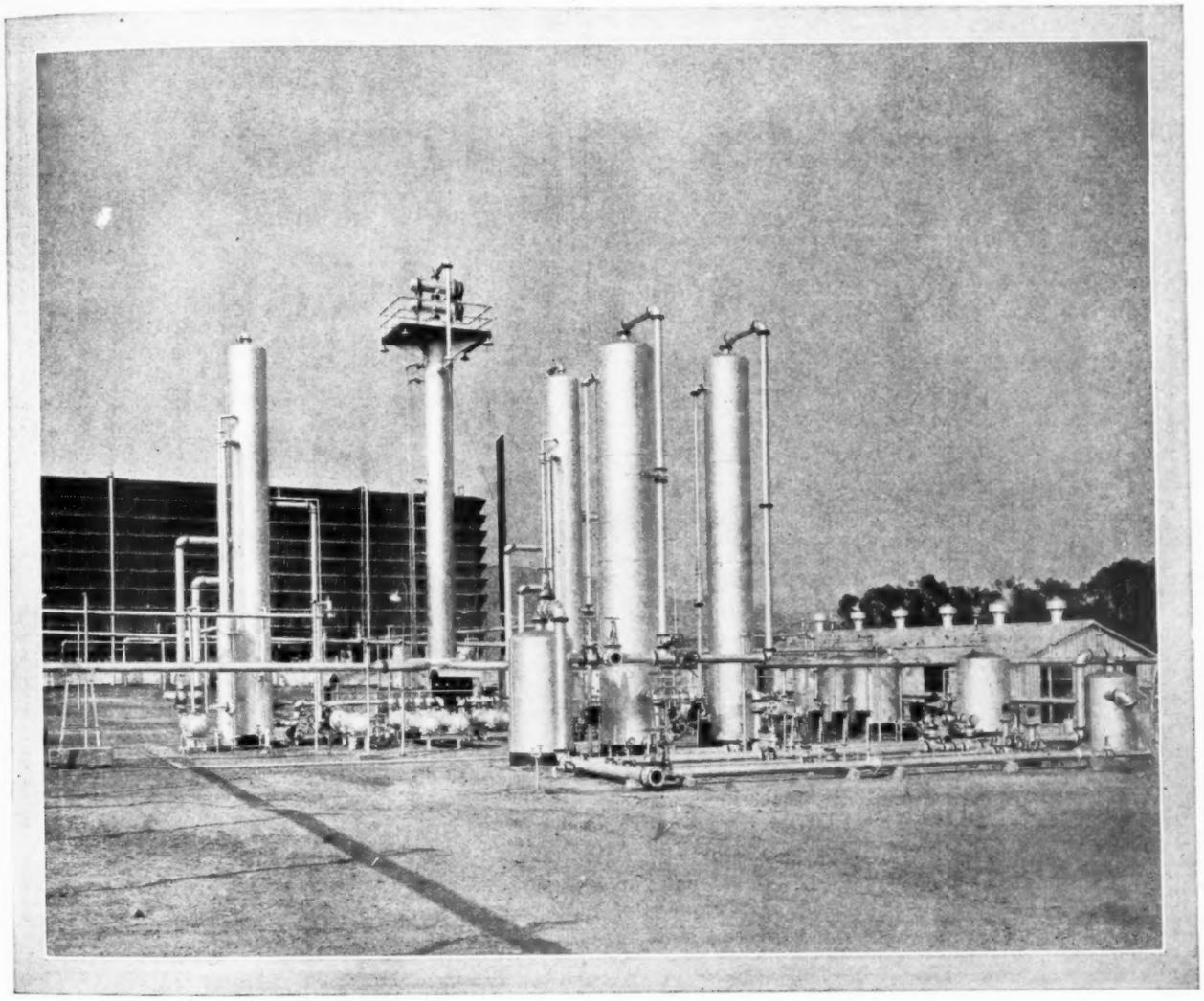
The National Tube Co. announces that Wm. J. McKee has been appointed manager of sales of oil country goods, and oil and gas line pipe in the states of Oklahoma, Kansas and Arkansas.

Wm. J. McKee

Harold Potter, civil engineer, Humble Oil & Refining Company, has been moved from Corsicana to Tyler, Texas.

Braun

QUALITY ⚖ PRICE



We have demonstrated to many customers, old and new, as we did to the owners of this large gasoline absorption and stabilization plant, that BRAUN quality products and workmanship are now obtainable at a price so low that quality no longer need be sacrificed for first cost. No longer need the engineer fear that low first cost means mechanical and operating deficiencies or high maintenance expense.

C. F. BRAUN & CO., INC.

ALHAMBRA • NEW YORK • CHICAGO • TULSA • HOUSTON

When writing C. F. Braun & Co., Inc., *please mention The Petroleum Engineer*

Dr. F. R. Baxter

Dr. Florus R. Baxter, chief of the oil testing laboratories of the Vacuum Oil Company, last month comp'eted 50 years' service with the company.

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W. L. Lewis, who for the past year has been vice-president in charge of finance of the Chicago Pneumatic Tool Company, New York, and was formerly assistant comptroller of the Bethlehem Steel Corporation, has been elected executive vice-president.

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C. E. Duffield and Ivan W. Howard of the Howard Petroleum Company, have moved from Tulsa to East Texas. Mr. Duffield can be found at Marshall, while Mr. Howard is located at Tyler.

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H. A. Wood, secretary of the E. H. Edwards Company, manufacturers of wire and wire rope, San Francisco, Calif., was a recent Mid-Continent visitor. Together with John Sloan, sales representative in the Mid-Continent, he called on a number of oil companies in Tulsa and later visited the East Texas fields.

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Lyle Brush, formerly with the Kerotest Manufacturing Company, is now with the Brauer Machine & Supply Company looking after the latter company's valve business.

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Pete Wallace of the Link Belt Co., who was formerly located at Oklahoma City, now has headquarters at Dallas, Texas.

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Bob Stoner, assistant general superintendent of the N. K. P. M. with headquarters in Sumatra, is spending a few months in the United States.

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A party of officials of the American Steel and Wire Co., composed of John May, assistant general manager of sales at New York City; C. F. Wiley, manager electrical and wire rope department of Chicago, and Joseph V. McGinity, special oil country representative at Tulsa, Oklahoma, are making a tour of the Mid-Continent territory.

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W. A. Pitts, who has been associated with the Regan Forge & Engineering Company for the past several years in the Mid-Continent territory, is now with the American Iron & Machine Works Company as sales representative.

Weston Payne

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Weston Payne has been appointed manager of production for the Anderson-Prichard Oil Corporation of Oklahoma City, Okla. Mr. Payne has had a wide experience in all phases of production as well as other departments of the oil business. He has previously served with the Empire, Marland and most recently with the Trinidad Leaseholds, Inc., located in the British West Indies.

Lyle Brush

J. M. Wadsworth has resigned as plant superintendent for the Phillips Petroleum Company at Kansas City, Kans., to become associated with the Foster Wheeler Corp., in New York City, as design engineer. Mr. Wadsworth has been in the oil industry a good many years and has had extensive experience in the operation and design of modern refineries.

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S. M. Kinter, who has been assistant vice-president of the Westinghouse Electric and Manufacturing Company, was elected vice-president in charge of engineering for that company at a recent meeting of the board of directors. He succeeds W. S. Rugg, who has been elected vice-president in charge of sales.

J. M. Wadsworth

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F. W. Waterman, president of the National Tube Co., announces the following changes in organization, effective June 1: J. J. Kennedy is now vice-president in charge of sales, succeeding J. H. Nicholson, retired; D. H. Ramsbottom becomes general manager of sales, succeeding Mr. Kennedy; Homer C. Gerwig and W. F. McConnor are both assistant general managers of sales, and James B. Graham has been transferred from superintendent of field work and inspection to the sales department in charge of field work.

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J. A. Fletcher, district superintendent in Western Kansas for the Barnsdall Oil Company, has been transferred to the East Texas area.

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George M. Laughlin, III, has been elected a director of the Jones and Laughlin Steel Corporation, Pittsburgh, Pa.

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E. F. King, chief engineer of main line stations, Humble Oil & Refining Company, has been transferred from Wayland, Texas, to Hobbs, New Mexico.

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N. C. Byars of the Republic Supply Company sales department at Kilgore, Texas, was married recently. Mr. Byars was formerly purchasing agent for the C. F. Camp Company of Tulsa.

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C. Wilson, Jr., vice-president and general manager of the Harrisburg Pipe and Pipe Bending Co., Harrisburg, Pa., is now also general sales manager, a position previously held by H. W. Bishop, Jr., who is no longer with the company.

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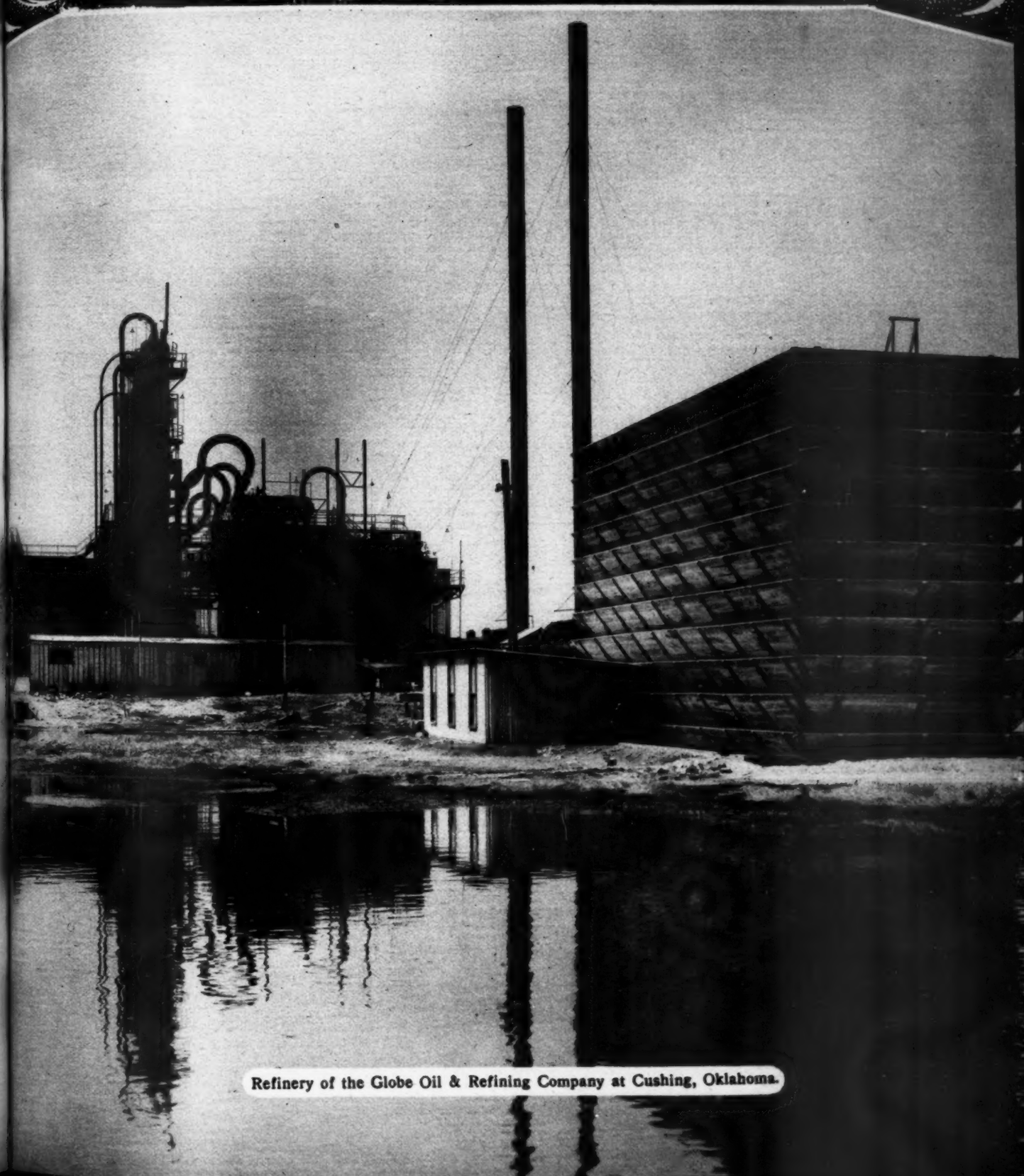
Dr. R. E. Wilson, head of the development and patent department of the Standard Oil Co., of Indiana, has been elected to the board of directors. Dr. Wilson, an outstanding technologist of the refining industry, has been with the Indiana Company since 1922.

Robert E. Wilson

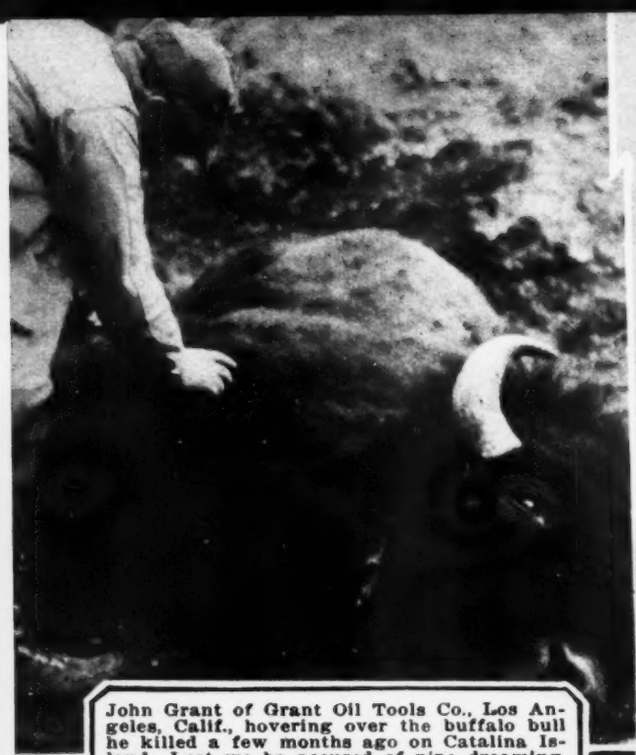
Pictorial Petroleum

MONTHLY ROTOGRAVURE FEATURE OF THE PETROLEUM ENGINEER

JUNE 1931



Refinery of the Globe Oil & Refining Company at Cushing, Oklahoma.



John Grant of Grant Oil Tools Co., Los Angeles, Calif., hovering over the buffalo bull he killed a few months ago on Catalina Island. Lest we be accused of pipe dreaming, we hasten to explain that the buffalo was one of twelve left on the island some seven years ago, after the filming of the photoplay "The Thundering Herd". It was while hunting for wild goats that Mr. Grant discovered the herd and, after gaining a permit, brought down the bull shown with his 30.06 Springfield rifle.

W. W. Robinson, Jr., petroleum engineer The Texas Company, Long Beach, Calif.

J. C. Carothers, master car builder, Lone Star Gasoline Company, Ranger, Texas.

Scene o
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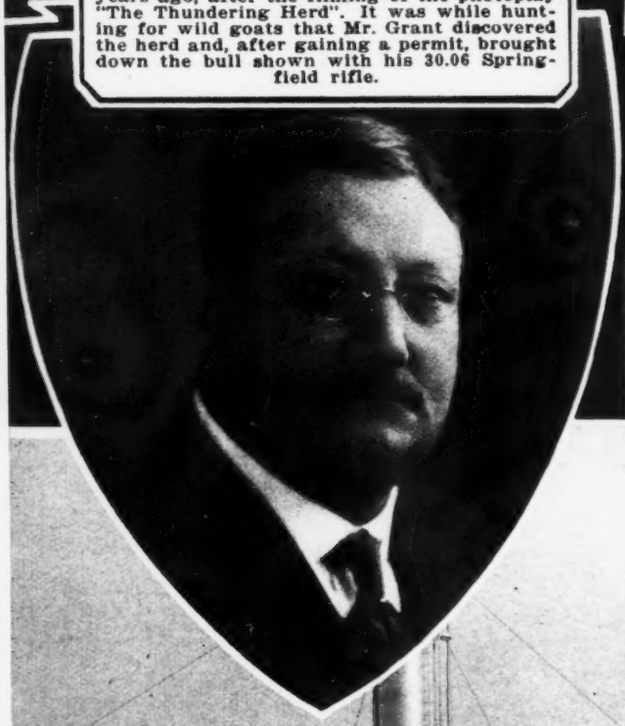
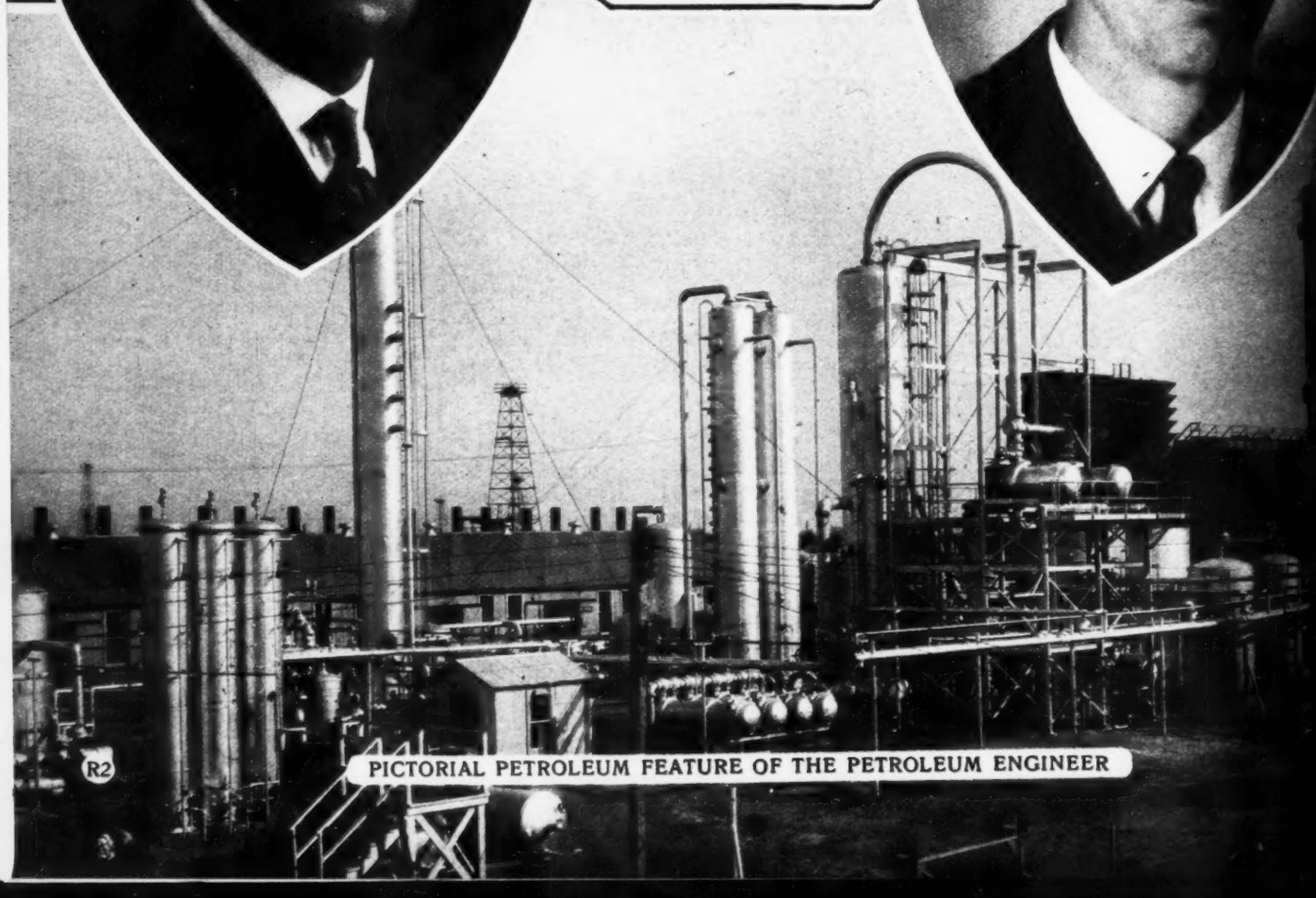


Left—C. W. Carlson, San Antonio, Texas, representative for Jenkins Bros., valve manufacturers, New York; right—Herbert J. Barnsley of the engineering division of Jenkins Bros. Below—Walter Wise gasoline plant of Carter Oil Company, Bowlegs, Oklahoma.



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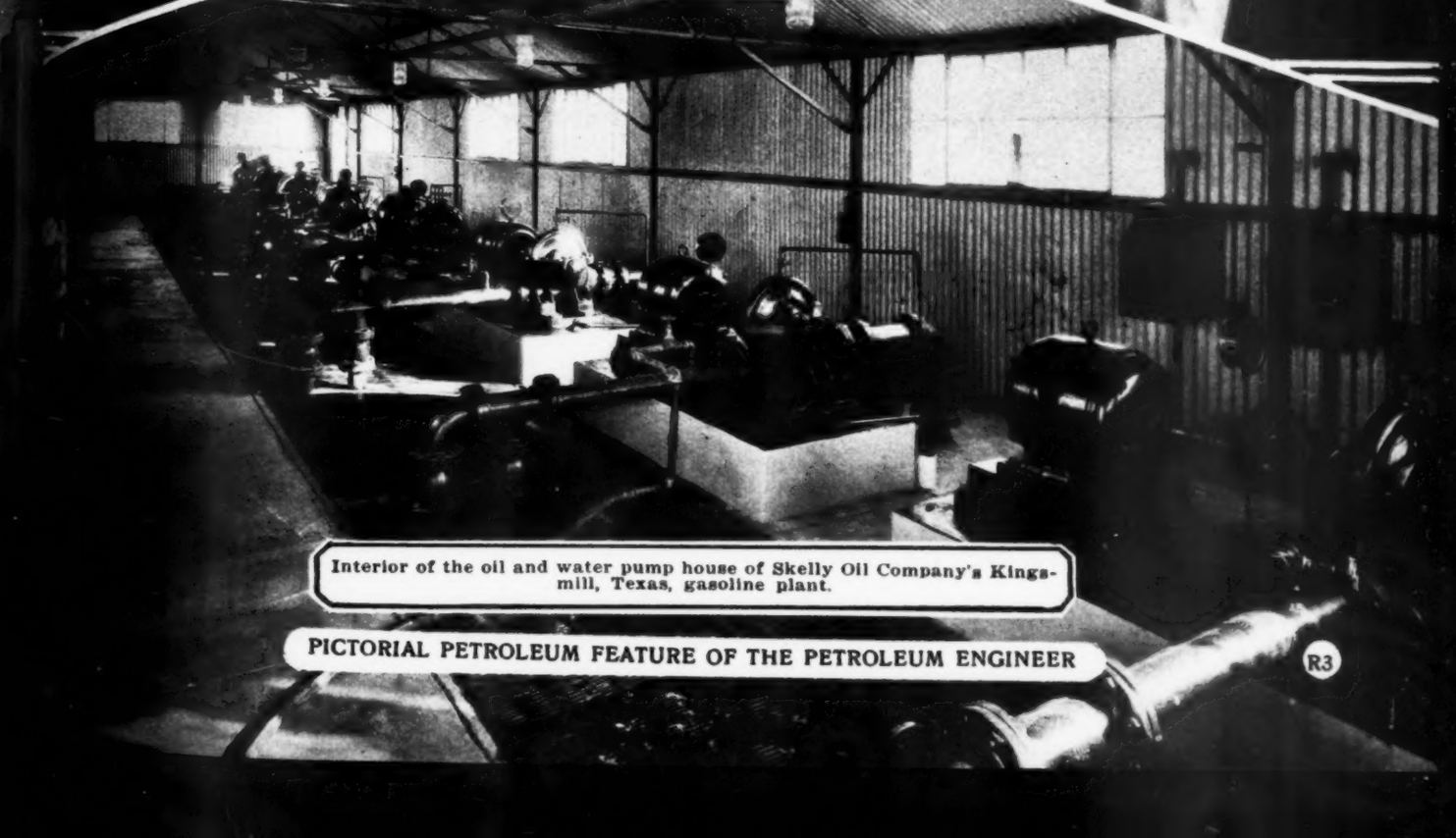
PICTORIAL PETROLEUM FEATURE OF THE PETROLEUM ENGINEER

Scene on a Cities Service Gas Company 12" line taken in northeastern Oklahoma.

Electric welding a 24" combination welded and coupled gas line.

Left—N. K. Clements, chief engineer, Carnegie Natural Gas Company, Leechburg, Pa. Above—Sidney S. Smith, new president of the Natural Gasoline Association who is head of the Natural Gasoline Department of Shell Oil Corporation, Tulsa, Oklahoma. Right—J. L. Hamilton, chief engineer, Lone Star Gas Company, Brazos, Texas.



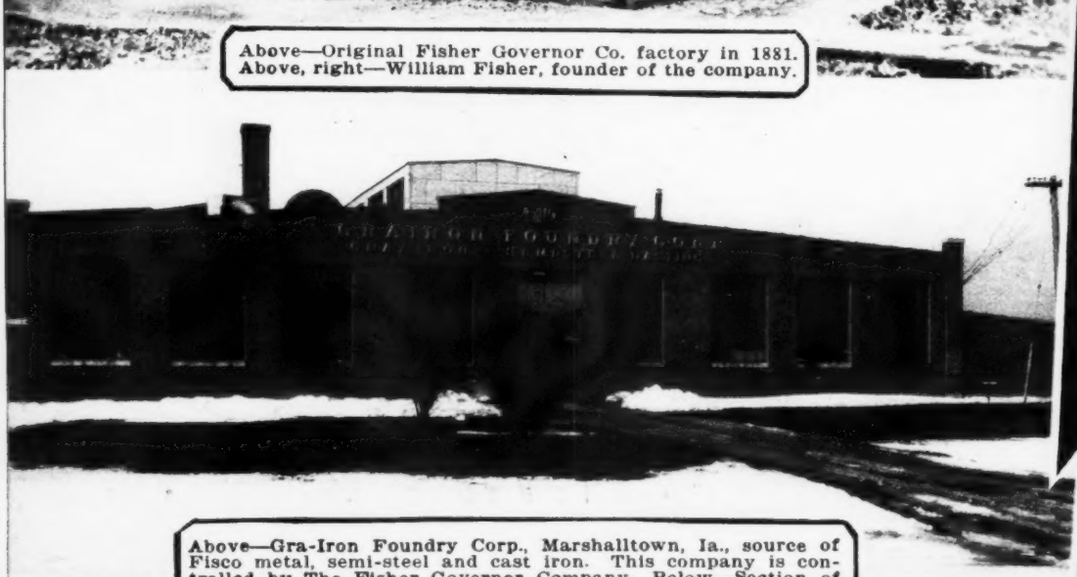
Interior of the oil and water pump house of Skelly Oil Company's Kingsmill, Texas, gasoline plant.

Browne says: The First 50 Years are

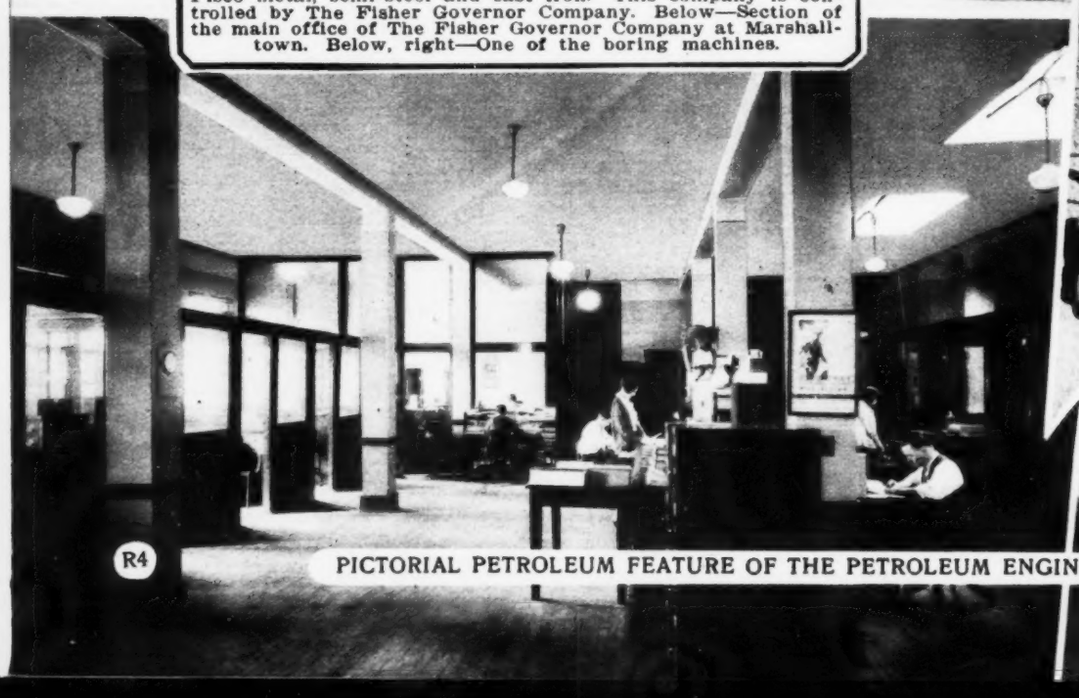
Above—Original Fisher Governor Co. factory in 1881. Above, right—William Fisher, founder of the company.

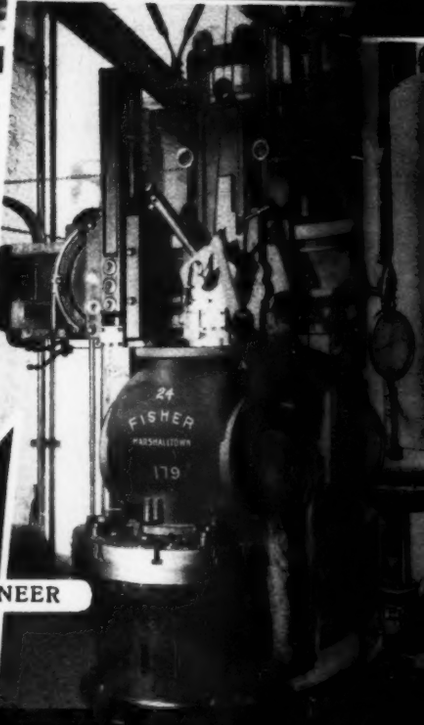
The Fisher Governor Co... Marshalltown, Ia., is this year ... brating its 50th Anniversary. Fo... ed in 1881 by William Fisher, ... developed the first constant pre... pump governor, the organization ... grown steadily year by year and ... contributed in a tremndously im... tant way to the development of ... control equipment.

Although as L. W. Browne, ... ent president says, "the first ... years are the hardest," it is app... that each has been a productive ... and has added to the prestige ... sphere of service of the com... Contrast the modest frame pla... 1881 with the ultra-modern str... of today (both shown in accom... ing photographs) and the st... the progress of The Fisher Go... Company is told without ... for words.



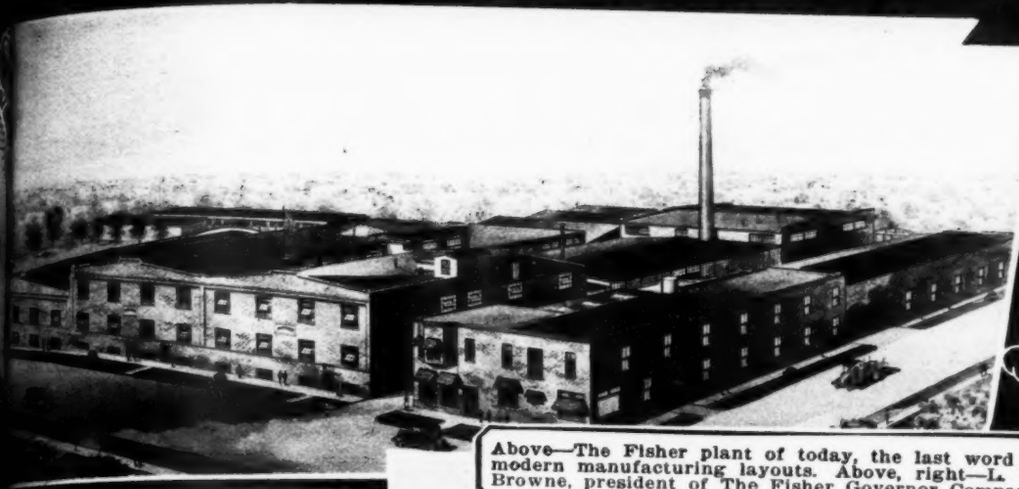
Above—Gra-Iron Foundry Corp., Marshalltown, Ia., source of Fisco metal, semi-steel and cast iron. This company is controlled by The Fisher Governor Company. Below—Section of the main office of The Fisher Governor Company at Marshalltown. Below, right—One of the boring machines.





rs are the Hardest

1881
1931



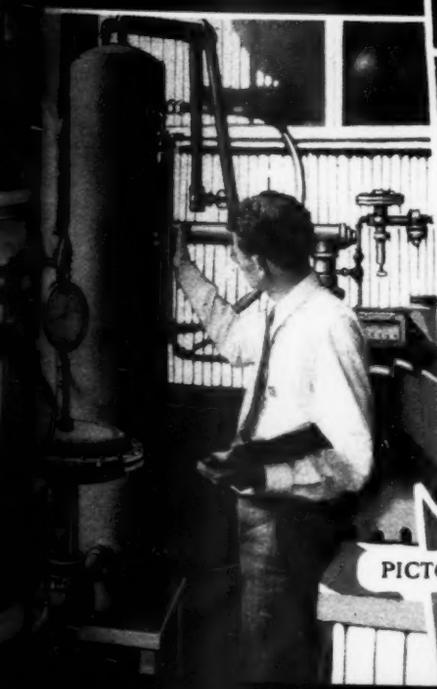
Above—The Fisher plant of today, the last word in modern manufacturing layouts. Above, right—L. W. Browne, president of The Fisher Governor Company.

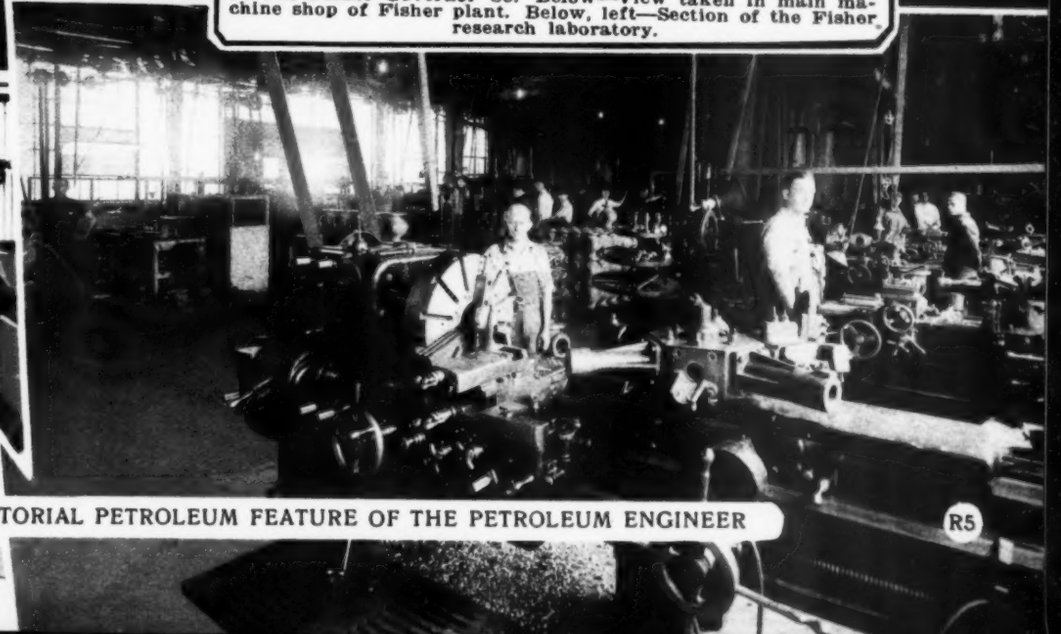
That the Fisher organization considers its 50th anniversary only a starting point for further and greater development is brought out by the recent announcement of the establishment of a branch factory in Los Angeles, Calif., to be under the supervision of J. H. Fisher, chairman of the board of directors. Factory management will be in the hands of Ray McCoy. Connection with Midwest Piping & Supply Co. as sales representatives in California will be retained.

Complete stocks of castings and parts for all Fisher controllers will be carried at the Los Angeles factory, where also are being installed facilities for machining, testing and rebuilding, as well as the manufacture of new equipment.

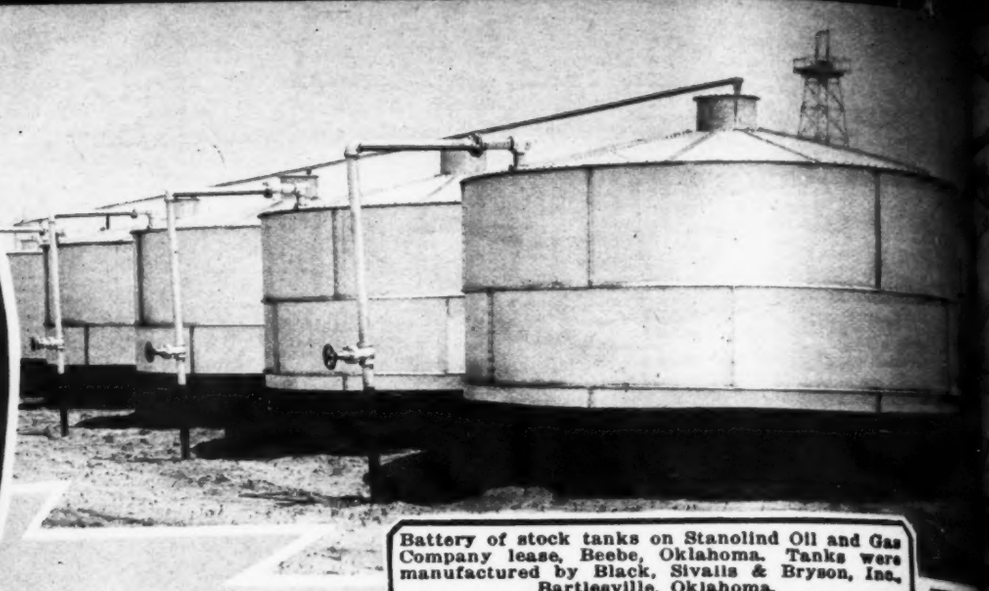
Plant of The Kiowa Corp., Marshalltown, Ia., a bronze foundry from which the Fisher organization obtains its aluminum and bronze castings. This Corporation is also controlled by Fisher.

Above—The Apex Regulator Co., Marshalltown, Ia., a subsidiary of The Fisher Governor Co. Below—View taken in main machine shop of Fisher plant. Below, left—Section of the Fisher research laboratory.



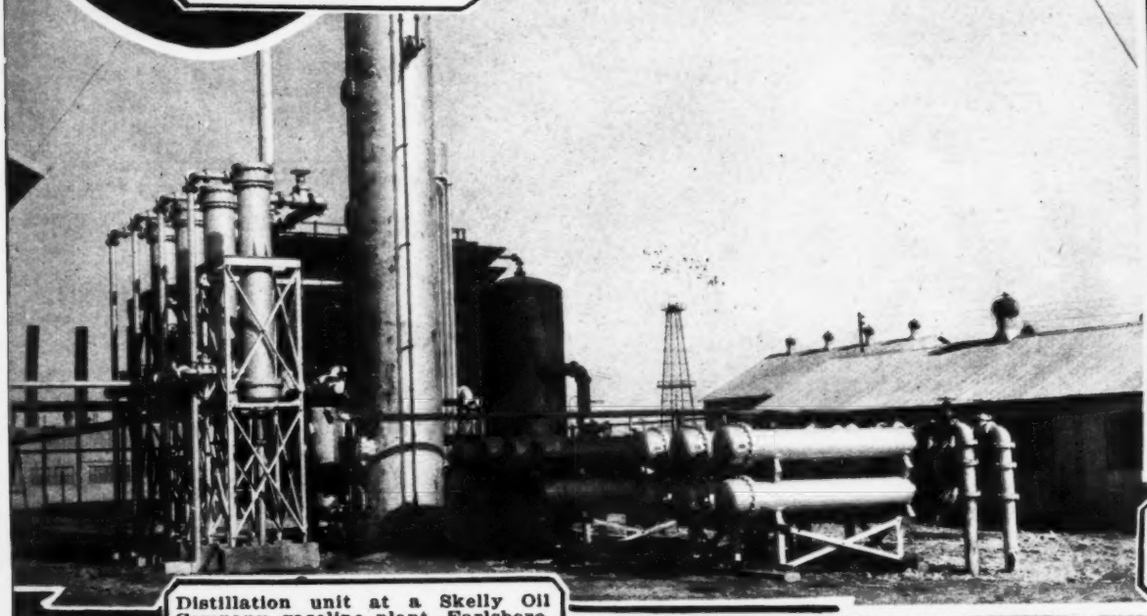


P. N. Guthrie, Jr., New York City, president, Reading Iron Company.



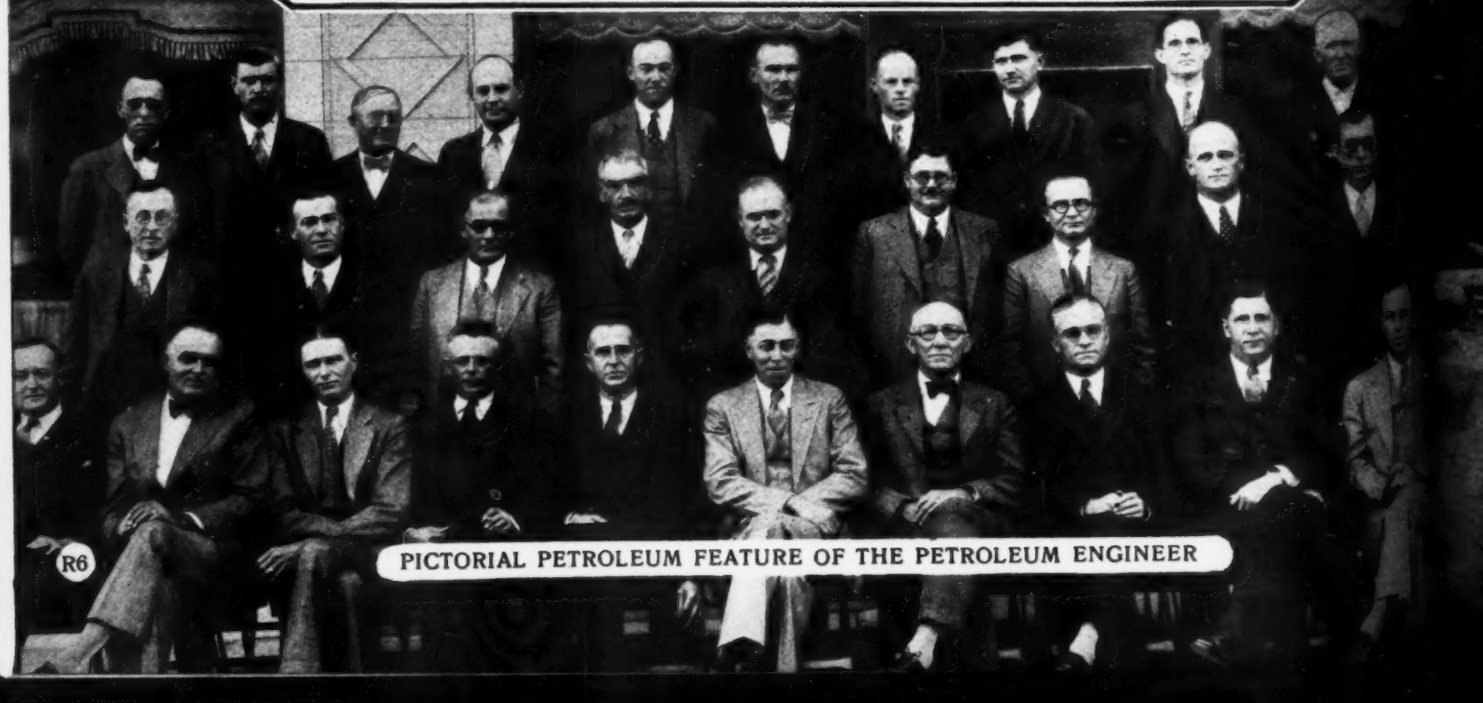
Battery of stock tanks on Stanolind Oil and Gas Company lease, Beebe, Oklahoma. Tanks were manufactured by Black, Sivalls & Bryson, Inc., Bartlesville, Oklahoma.

Herman J. Little, petroleum engineer for South Penn Oil Company at Pittsburgh, Pennsylvania.

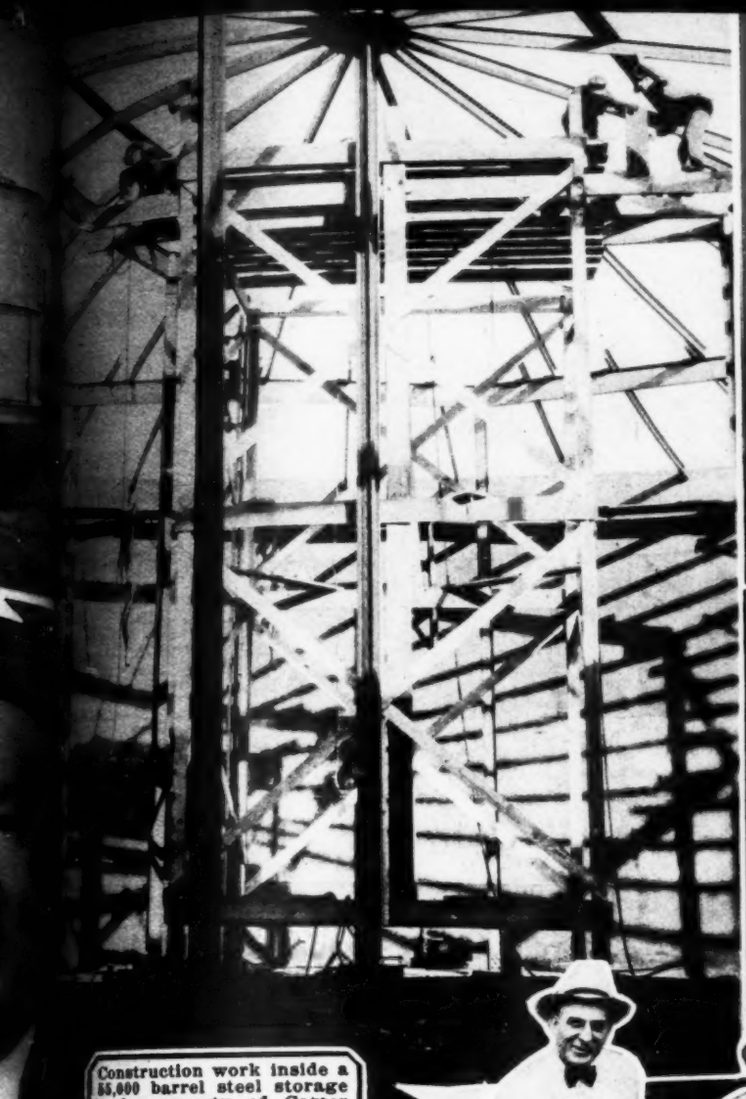


Distillation unit at a Skelly Oil Company gasoline plant, Earlsboro, Oklahoma.

A group of The Empire Companies' oil division operating men. Front row, left to right, N. H. Moore, Earl E. Ives, D. D. Bodie, C. S. Warren, G. E. Goddard, M. M. Mahaffey, W. H. Betz, M. R. Shaffer, J E. Howell and C. E. Beecher. Middle row, left to right, E. G. Brua, J. P. Murray, W. F. St. Clair, W. G. McClune, H. J. Cousland, S. P. Gates, Charles I. Galloup, C. P. Conover and Earl Dowse. Back row, W. W. O'Neill, B. I. McClune, A. J. Leonard, L. A. Ogden, F. A. Lawrence, J. A. Cleverley, N. M. Hutchinson, R. C. Hauber, Sam Harlan and W. Williams.



Above—E. H. Poe, southwest division manager, Central States Power & Light Corp., Tulsa, Oklahoma. Below—W. F. Hebeler, general superintendent of the same division.



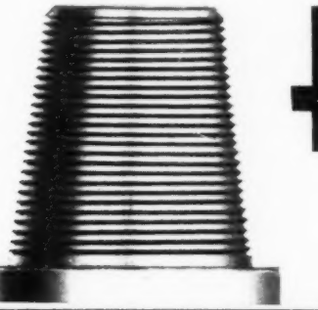
Construction work inside a 55,000 barrel steel storage tank; property of Carter Oil Company, Seminole field, Oklahoma.

Three well-known Prairie Pipe Line Company men who make their headquarters in Tulsa, Oklahoma. Left to right—L. F. McLaughlin, assistant master mechanic, L. M. Gulleson, chief electrician, and J. C. McConnell, assistant division engineer.

Left—Scene taken on a recently constructed 12" oil line in East Texas. Right—A gas well in the Monroe, Louisiana, field located typically in the midst of dense growth.

Aerial view of Associated Oil Company refineries at Avon, California.

CORE



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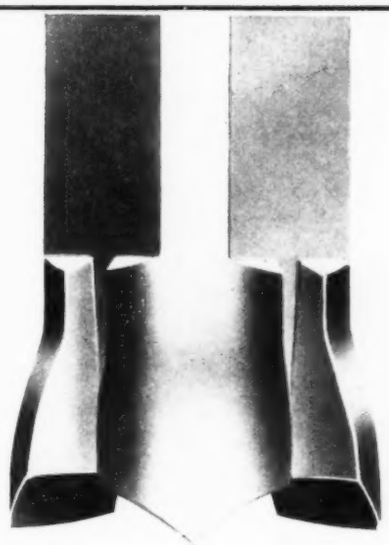

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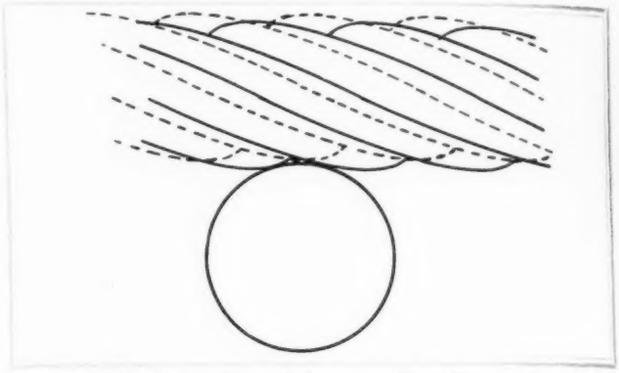
Some Factors Influencing Sheave Design

By WALTER VOIGTLANDER,
Chief Engineer, Union Wire Rope Corp., Kansas City, Mo.

IN the study of "Internal Stresses of Wire Rope,"[1] it was assumed that the rope was bent around the sheave with an arc of contact sufficient to produce the maximum stresses within the rope. It is a well-established fact that when a rope makes sheave contact of an arc equal to the length of the rope lay, then the maximum stresses have been produced within the rope for that sized sheave. To wind the rope around the sheave with a greater arc of contact will not produce a greater stress within the rope, but will subject a longer portion of the rope to these same maximum stresses. Thus, Chart No. 3[1] shows, in Curve A[1], the arc of contact for varying sheave sizes that will produce the maximum internal stresses within hemp centered hoisting ropes as discussed in Chart No. 1[1], viz., those ropes having a rope lay of 6d.

There are numerous cases where ropes pass over sheaves with less contact on the sheaves than those shown in Curve A[1]. The extreme condition would be, for example, a haulage rope supported on rollers on a level plane. It has been found in practice that here too is an economical minimum diameter of roller, as otherwise a very small roller would follow the elemental contour of the rope which would raise and lower the rope somewhat as seen in the accompanying cut; this condition sets up a "chattering" of the rope, destructive to both the rope and the roller. There are



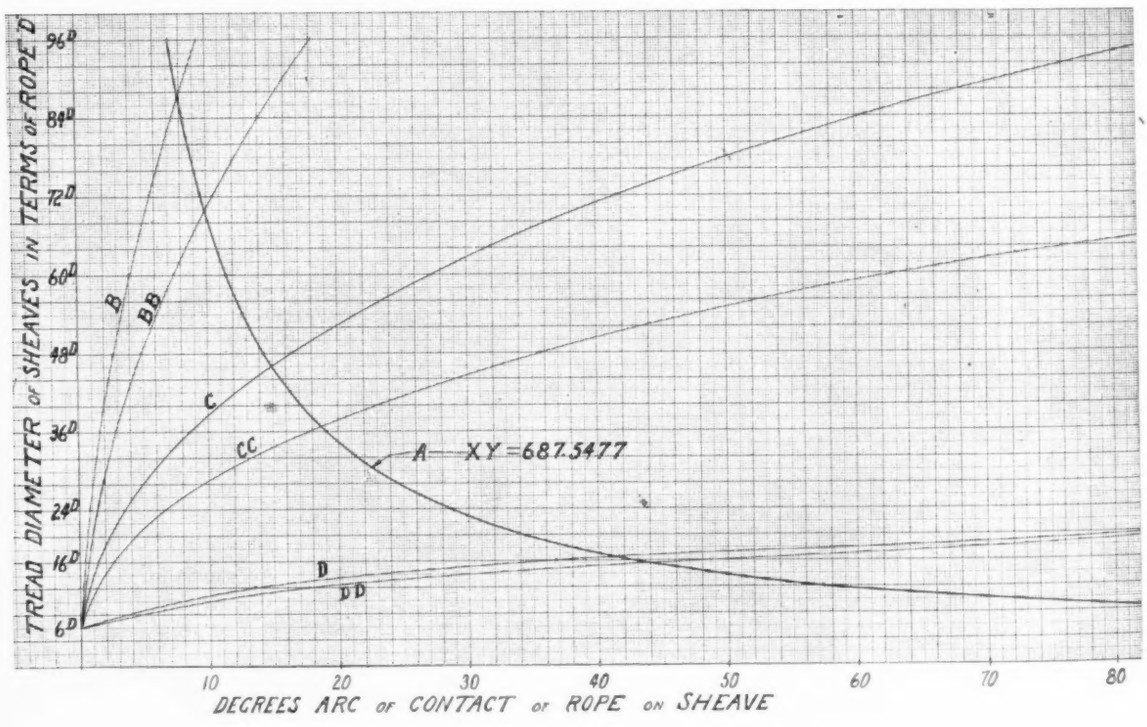
two considerations for minimum roller diameters, one for grooved rollers and the other for flat-faced rollers. The minimum roller sizes should be:

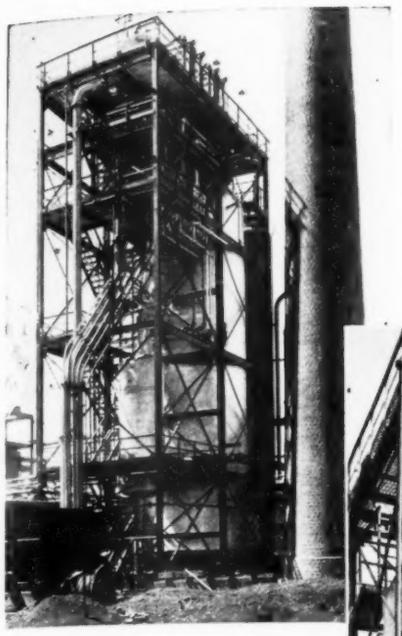
For *grooved* rollers—tread diameter equal to length of rope lay.

For *flat-faced* rollers—diameter equal to 4/3 times length of rope lay.

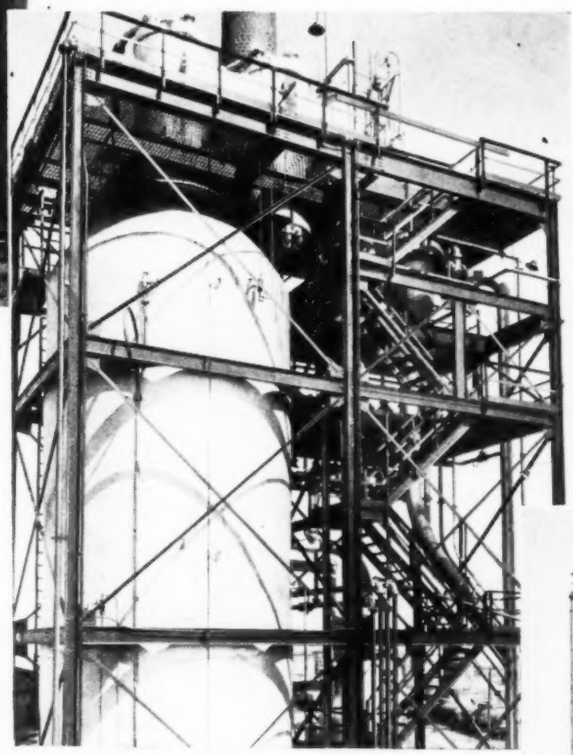
[1] See 1931 Midyear issue "The Petroleum Engineer".

CHART No. 1





VACUUM STILLS



That Are

COMPLETED

and

STARTED UP

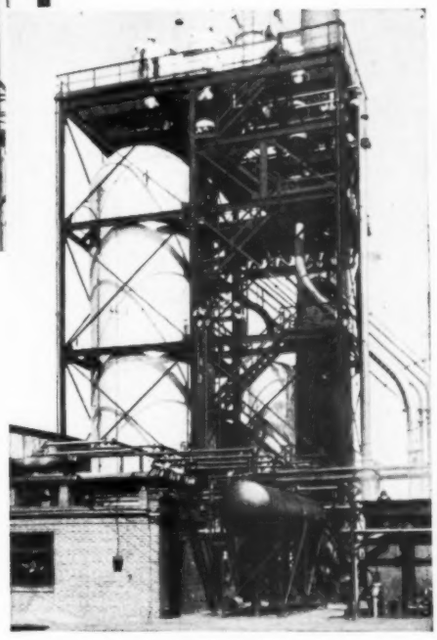
and

MEET

PERFORMANCE

GUARANTEES

and



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Curves B, BB, C, CC, D, DD, on Chart No. 1, represent the minimum *grooved* sheave sizes all starting from 6d tread diameter for ropes having a 6d rope lay, that is, a lay equal to 6 times the diameter of the rope. Curves B, C and D are the minimum tread diameters of sheaves for a unit rope stress of 50,000 pounds per square inch, for sheaves of cast iron, steel castings and manganese steel castings, respectively; Curves BB, CC and DD similarly for a unit rope stress of 40,000 pounds per square inch.

It will be noted that any change in the length of relative rope lay will require a new A curve; and for every change in the unit rope stress there will be different B, C and D curves. The A curves are plotted from the general equation:

$$xy = \frac{360}{\pi} \times \frac{\text{Relative Rope Lay}}{d} = 114.5913 \times \frac{\text{Relative Rope Lay}}{d}$$

From this equation we have:

For relative rope lay of 6d.....xy=687.5477

For relative rope lay of 6¼d.....xy=716.1956

For relative rope lay of 6½d.....xy=744.8434

For relative rope lay of 6¾d.....xy=773.4912

For relative rope lay of 7d.....xy=802.1390

For relative rope lay of 7½d.....xy=859.4347

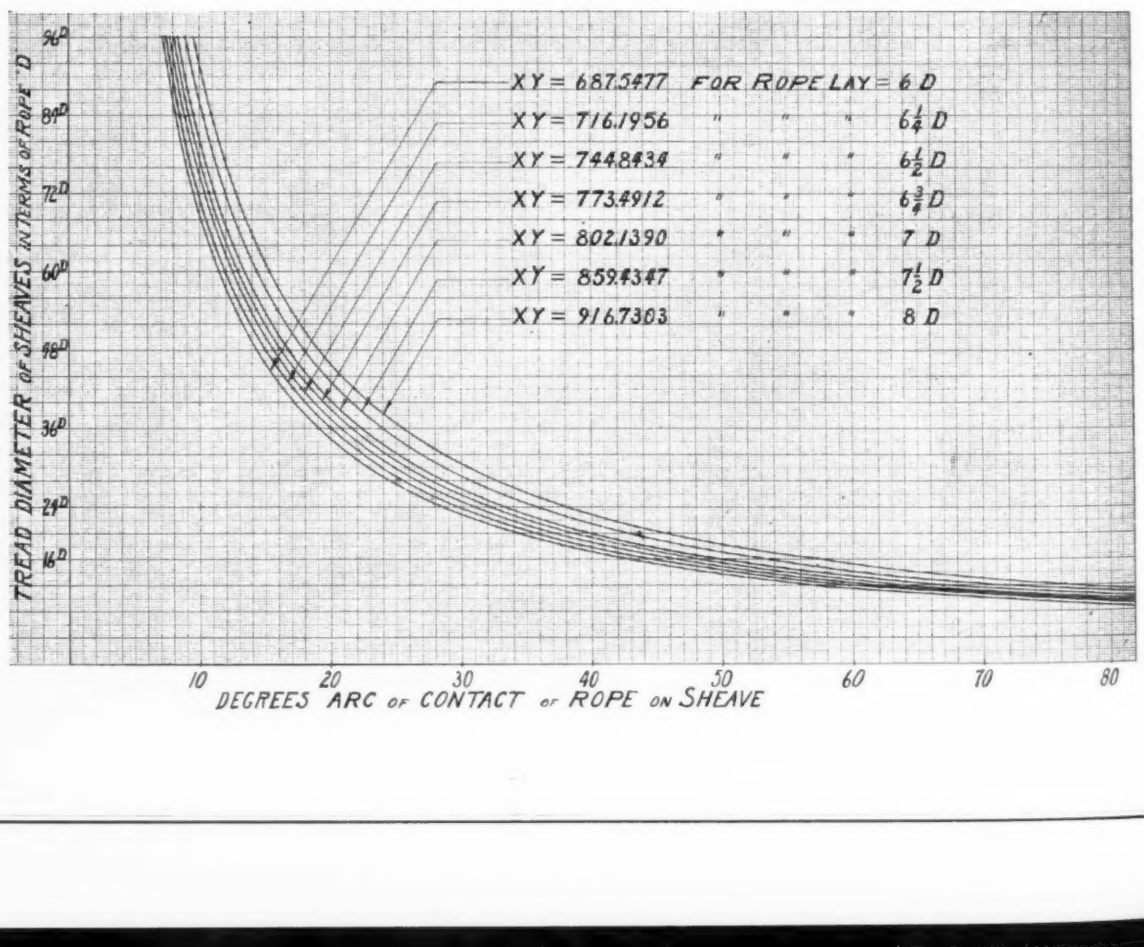
For relative rope lay of 8d.....xy=916.7303

These equations are graphically represented by the curves on Chart No. 2.

The B, C and D curves are derived from the general equation $P=D^m$ where "P" is the pressure per unit of length (pound per linear inch) of the rope on the sheave; "D" is the tread diameter of the sheave; and the exponent "m" is a variable dependent upon both the intensity of the rope stress "T" and upon the unit radial pressure "p" given in the following table for various rope constructions and various materials in the sheaves:

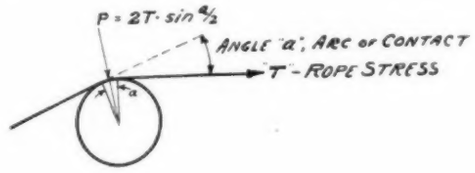
Material of Sheave Groove	6x7	6x19	6x37	8x19	Remarks
Wood	150	250	300	350	End grain of beech, gum, hickory.
Cast Iron	285	475	570	665	
Carbon Steel Castings	540	900	1080	1260	.30–.40 Carbon.
Chilled Cast Iron	660	1100	1320	1540	Not advised unless of uniform hardness.
Manganese Steel	1500	2500	3000	3500	Grooves should be ground.

CHART No. 2



To plot values of "m" we have $m=\frac{\log P}{\log D}$; also $P=2T$. $\sin\frac{a}{2}$ as represented in the accompanying cut; also the unit radial pressure $p=\frac{P}{d}$ where "d" is the rope diameter, and since $P=\frac{T}{R}=\frac{2T}{D}$, we have $p=\frac{2T}{Dd}$; and "a" the angle

$$x=\frac{114.5913}{D}\times\frac{\text{Relative Rope Lay}}{d}$$



Assuming d = 1 in all equations; the relative rope lay = 6d; taking 6x19 construction rope on Cast Iron sheaves (for which p = 475 from the table); and a unit rope stress of, say, 40,000 pounds per square inch—then, since the metallic area of the assumed rope is .414 square inch, T = 40,000 × .414 = 16,560 pound rope stress.

$$D=\frac{2T}{p}=\frac{33120}{475}=69.68$$

$$a=\frac{114.5913}{69.68}\times\frac{6d}{d}=9.867 \text{ degrees}$$

$$\sin\frac{a}{2}=\sin 4°\text{—}56'=.08632$$

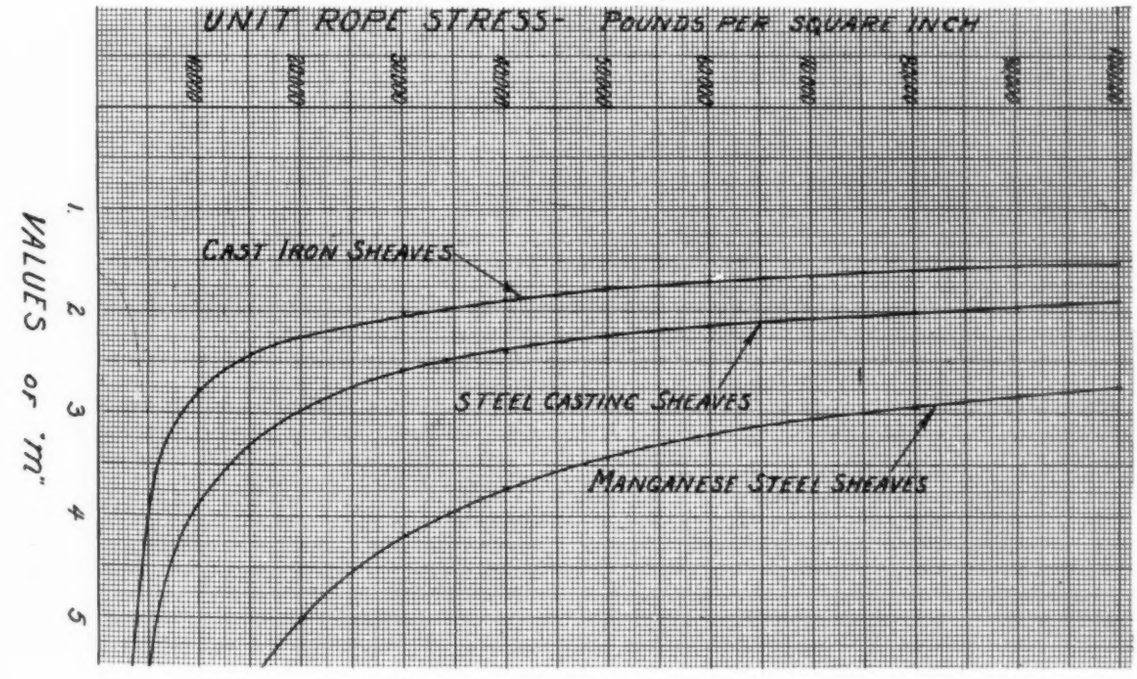
$$P=2T.\sin\frac{a}{2}=33120\times.08632=2847 \text{ pounds.}$$

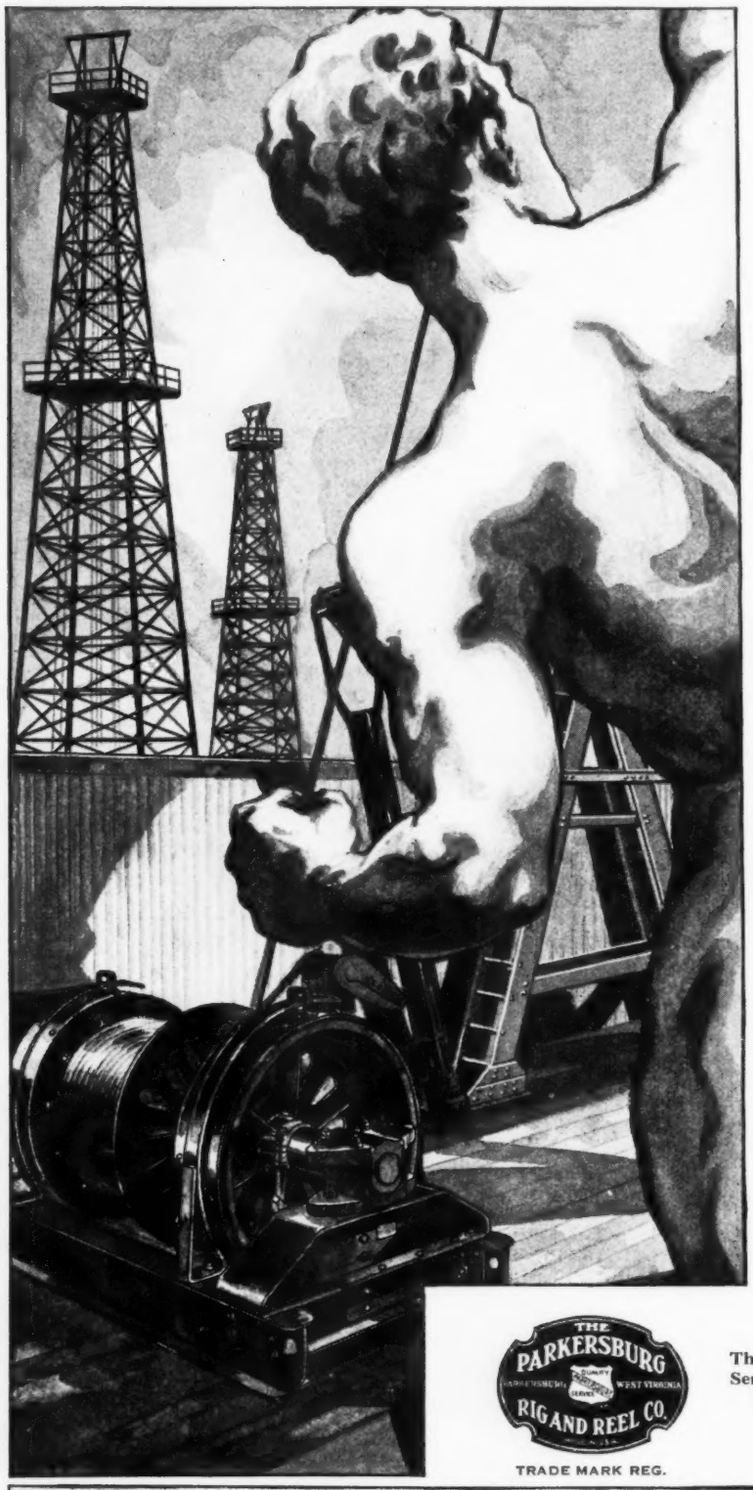
$$m=\frac{\log P}{\log D}=\frac{\log 2847}{\log 69.68}=\frac{3.45439}{1.84313}=1.8742$$

Thus one point on the "m" curve is located by x = 1.8742 and y = 40,000 pounds per square inch.

Similarly the three curves on Chart No. 3 were located for values of p = 475, 900 and 2,500, respectively, for sheaves of cast iron, steel castings and manganese steel castings and from which intermediate values of "m" can be secured to plot the B, C and D curves for any unit rope stress by substituting in the equations given above.

CHART No. 3





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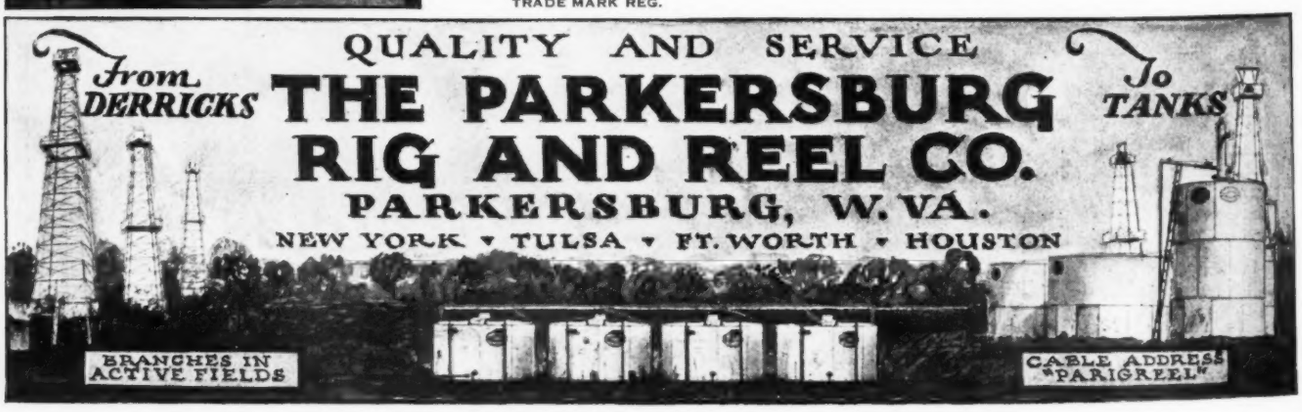
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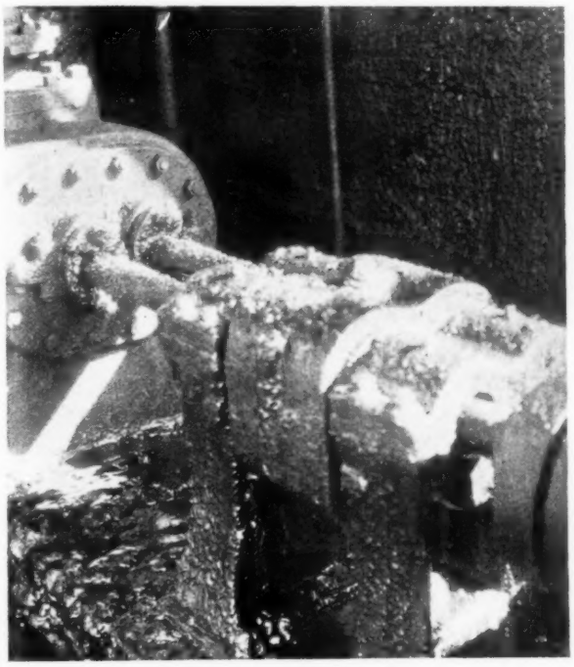
Methods of Mixing Sludge Fuel

By
GEORGE PFAU, Supt., *and* C. A. BARRERE,
Asst. Supt., *Texas Pacific Coal and Oil Co.*

CONVERTING acid sludge to sludge fuel is a difficult process often attempted but seldom satisfactorily accomplished. Experiments with the process have cost the industry dearly in time and money and, as yet, the problem has not been universally solved. Lubricating oil sludge ponds exist as silent evidence of the difficulties encountered by pioneers in the treatment of lubricating oil; and rare indeed is the refiner who can point with pride to the fact that he has no sludge pond.

Originally the practice of dumping sludge in ponds or pits caused considerable ill feeling against refiners, as these ponds often overflowed or their contents seeped into nearby streams. Ultimately legislation was enacted against such pollution and various methods of recovering acid from sludge then sprang up, since the acid contained in sludge was considered the most objectionable ingredient. With more or less efficient recovery of the acid it was soon realized that the light oil sludges could be utilized as fuel, and this practice was readily adopted.



Screw type sludge pump.

However, with the growth of the lubricating oil industry, when the same methods were tried, numerous difficulties arose. Although it was but natural to expect that the process could be accomplished by the simple methods used in connection with lighter acid sludges, such was not the case, and refiners soon learned that the problem was indeed involved.

Until recently the heavy oil sludges were used only in small quantities, usually after a slight preliminary treatment. Because of the methods of preparation used, the so-called sludge fuels contained only a small proportion of sludge. Blended fuels were burned almost entirely under the boilers without regard to boiler efficiency or facility of operation, the idea being to get rid of the sludge at the least possible cost.

At the present time several refiners burn sludge as high as 80 per cent, as liquid fuel, not only in their power plants but in all distillation operations as well.

Once sludge is deposited upon the ground, it cannot be liquefied. Due to its containing a quantity of unsaturated compounds, making it readily susceptible to oxidation, it hardens overnight and, in this condition, cannot be recovered or burned successfully.

Most refiners find it advantageous to put their heavy oil through two treatments, commonly called the cutter and body acid treatments, respectively, the cutter acid usually being several pounds lighter per barrel than the body acid. This article will, therefore, stress the two-stage acid treatment.

Sludges consist of asphaltic compounds and sulphuric acid combined chemically and, to some extent, physically. The free acid content of the cutter (first) sludge varies from 6 to 10 per cent and of the body sludge (second) 12 to 15 per cent, the total acid content being 20 to 25 per cent and 50 to 55 per cent, respectively. It is obvious that acid water may more easily be recovered from the body sludge than from the cutter sludge.

Plant Layout

A simple method for the utilization of acid sludge by its conversion into sludge fuel follows:

Three lead-lined kettles are necessary — A, B and C in accompanying sketch — having a combined capacity of at least two and one-half times that required for the finished sludge fuel. They should be of small diameter and have a 30-degree cone or a 45-degree sloping bottom. Deep kettles are an advantage, as there is less likelihood of sludge boiling or splashing over the top. Kettles should be equipped with coils (open and closed) through which air and steam can be admitted, as shown in diagram (a). Suction and discharge lines (b and d) should be so equipped that they can be blown or steamed out to prevent plugging. A water line (c) enters each kettle. However, only one kettle needs water, but, if similarly equipped, kettles may be interchanged if necessary. They should be manifolded so that the contents can be pumped from one to the other. A swing line (e), on top, is provided for each kettle. Three pumps are necessary: E, to transfer the sludge from the agitator to the kettles; F, to transfer from one kettle to another, and discard the finished fuel; G, to remove the recovered acid; and H, to recover the oil off the cutter sludge. A lead-lined acid separator, D, having three compartments and necessary lines and fittings for separation of any entrained sludge, completes the layout.

Preparation

Sludge from the cutter acid is pumped from the agitator by pump E to kettle A. It goes through a strainer made of 10-inch pipe, one foot long and welded on each end and, with exception of the top, being perforated with ⅜-inch holes. The function of the strainer is to disintegrate the sludge into small particles. Open steam and air are introduced into the kettle while drawing the sludge in. When the total mass is in the kettle, all agitation is suspended and the contents allowed to settle. The temperature at this point should be 160 to 175 degrees F.

After settling four hours, any oil that may have risen to the top of the sludge is pumped off with pump H through swing lines (e) and returned to the agitators. This oil is of uniform quality (if not overheated) as that in the agitator, and nets a saving of from 3 to 6 per cent of the original oil per treat. At this point the sludge is again agitated and 30 per cent of fuel oil is added. The mass is heated (180 degrees F.) and mixed for three hours. Experience has shown that if the temperature is allowed to exceed 210 degrees F., particles of the sludge coke to a non-fusible mass and a grainy fuel results which will separate upon standing. Any type of fuel is suitable for mixing with the sludges.

Sludge fuel is then divided equally between kettles A and B, held warm with steam and agitated very slightly. Violent agitation in mixing sludge fuel causes the formation of lumps and emulsions.

The sludge from the second dump is then pumped with pump E to kettle C, through the spray. This kettle contains hot water (200 degrees F.), the ratio being two parts water to one part sludge. The water hydrolizes the sulfonates and forms free sulphuric acid. The mass is then agitated for one and one-half hours and allowed to settle for three hours. Difficulty may be encountered in separating the asphalt and diluted acid, but this entrainment may be eliminated by agitating solely by means of air.

The acid water settles to the bottom of the kettle and is drawn off (by gravity) to the acid separator (D). This water has a strength of 18 to 35 per cent sulphuric acid.

Hot water is again added to the kettle of sludge (C) in the ratio of one part water to one part sludge, and the same procedure followed as outlined above. This second acid water has a strength of 10 to 15 per cent sulphuric acid. The strength of the acid water made can be governed by the amount of water used and the time of agitation. If less water is used and the blowing time increased, an acid water as high as 40 per cent sulphuric acid can be obtained. If necessary to reduce the acidity to a minimum, another wash may be made; however, this is rarely necessary. The weak acid may either be mixed with oleum, to bring it to the required treating strength, or concentrated at a special acid recovery plant.

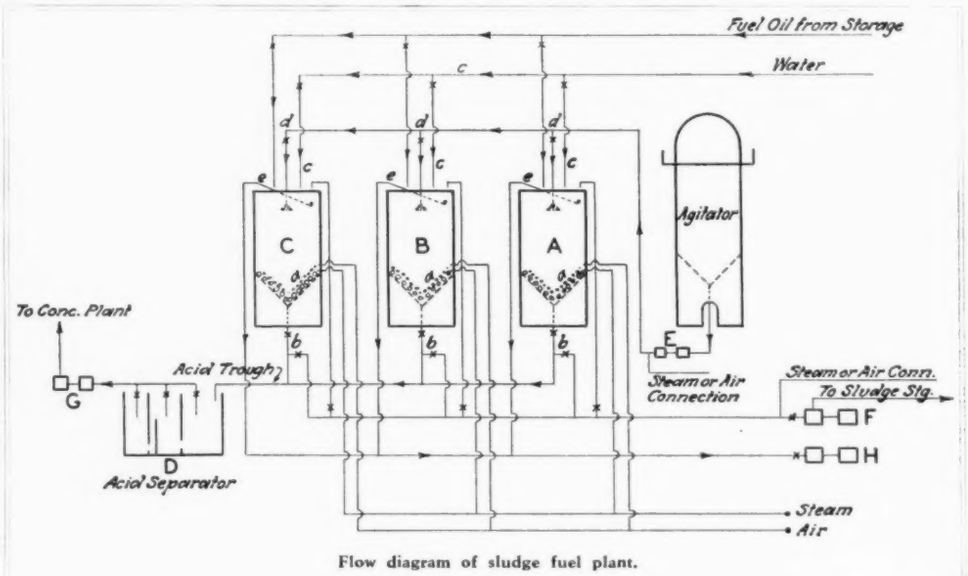
Typical Batch of Recovered Acid

Sludge charged	70 bbl.
Water added to first cook	105 bbl.
18.3% acid recovered	73 bbl.
93% acid equivalent	5,700 lbs.
9% acid recovered	91 bbl.
93% acid equivalent	3,200 lbs.
Total acid recovered (93% basis)	9,985 lbs.
Total acid content of sludge charged	12,100 lbs.
Per cent of total acid recovered	74.2%
Asphalt water-free basis recovered	49 bbl.

Thirty per cent of fuel oil is then added and the mass agitated with air and steam (210 degrees or higher). A higher temperature may be used here, as the acid is now removed and no difficulty with coking will be experienced.

After mixing the body sludge for one hour, it is pumped in equal amounts into the two kettles, A and B, containing the divided cutter fuel, agitated for one-half hour and pumped with pump F to the fuel storage.

This sludge fuel is a smooth, homogeneous mass, free from lumps, and will not settle out. It requires no mechanical mixing or circulating. Care must be taken, however, not to have too much oil entrained with the sludge from the agitator, as in that event it will be difficult to separate the acid water from the body sludge.



Flow diagram of sludge fuel plant.

Too high a treating temperature or prolonged blowing in the agitator will form a hard, brittle sludge difficult to keep in permanent suspension with fuel oil.

Tests on a completed batch of sludge fuel show: Gravity, 7.0; flash, 330; viscosity at 122-351; cold test, 50; B. S., 4.1; calorific value by Emerson bomb, 18020; moisture, 1.0 per cent; acidity, 1.0 per cent.

The amount of fuel oil added to the sludge can be varied according to the type of fuel desired. The lower the percentage of sludge, the lower the viscosity and cold test on the finished fuel, the method outlined above having that distinct advantage. By removing the acid from the body sludge a light weight tar is formed, which approaches the weight of fuel oil. It is soluble in all proportions with fuel oil. The cutter sludge, having very little free acid and composed of intricate carbon compounds, would be difficult to separate from the acid without serious emulsion trouble. However, by making a fuel of each and combining them, the body fuel acting as the base, we obtain a fuel that can be blended in almost all proportions with fuel oil of as low viscosity as 17 at 122, still eliminating the difficulty of attempting to remove the acid from the cutter sludge.

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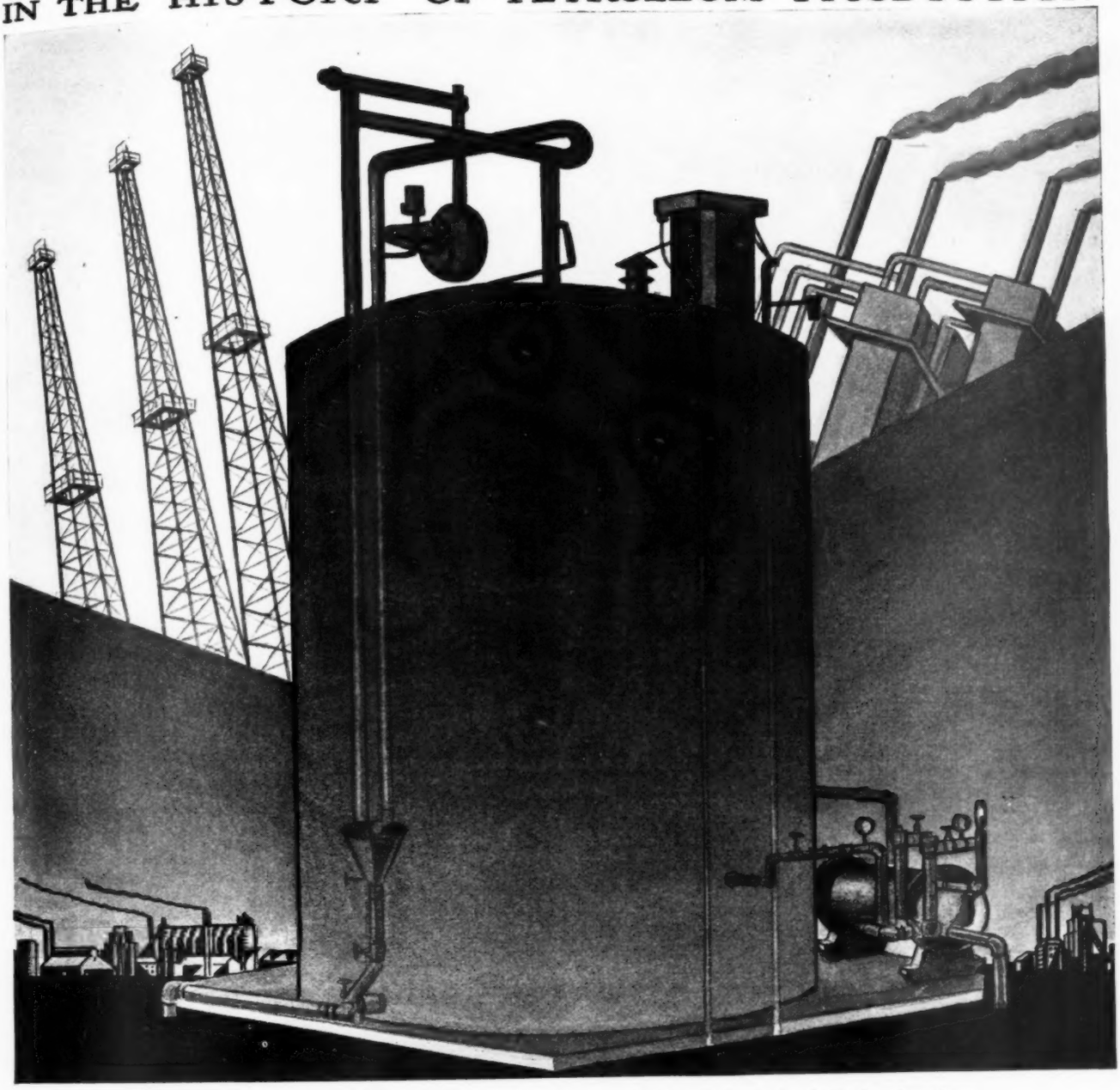

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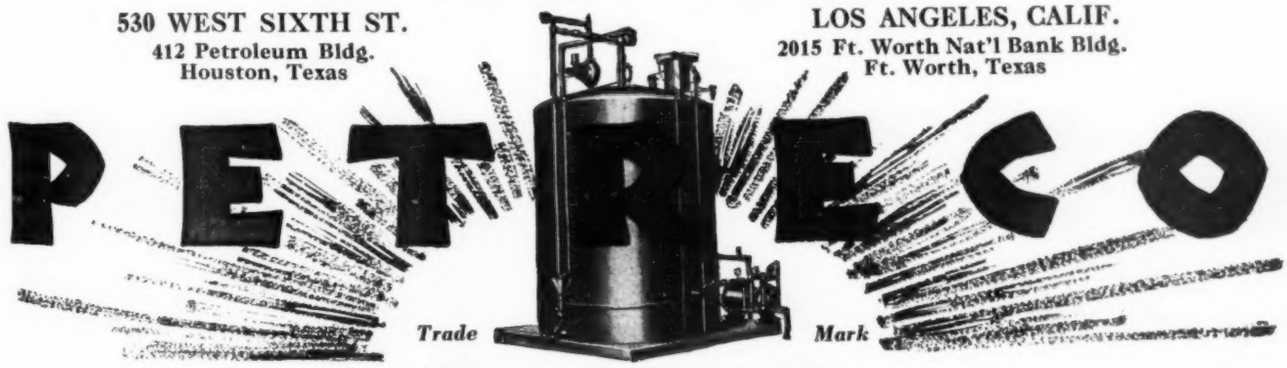

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Test on various blends with fuel oil and sludge:

Per cent sludge	10	20	25	75
Per cent fuel oil	90	80	75	25
Gravity	12.8	11.9	11	7
Flash	175	195	210	330
Vis. at 122	33	41	56	351
Cold test	—10	—10	0	50
B. S.	1.0	1.5	2.5	4.1

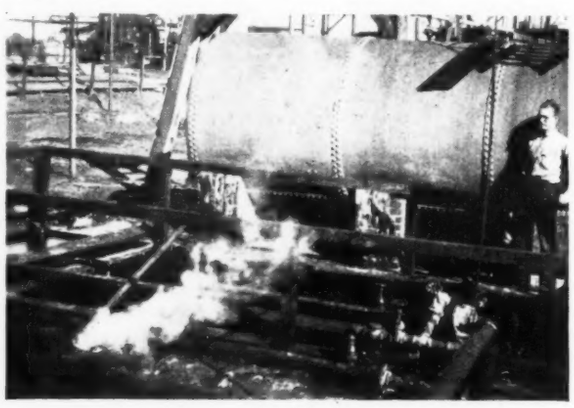
Other Methods

It is possible to prepare the sludge from one dump treatment, recover the acid water and make a similar fuel as above. This method is much more difficult, however, as trouble is encountered in separating the acid water. Usually a 40 per cent fuel mix is the limit obtainable.

Fuel may be prepared from the one- or two-dump method of treating without recovery of acid. This is desirable where there is no recovery plant and no possible use for the acid water. In this plant, due to the heaviness of the sludge containing the acid, a straight run fuel oil of high viscosity (200-300 at 122) is required. If low viscosity cracked fuel is used, the sludge will not remain in suspension. A 50 per cent mix of fuel and sludge gives the best fuel, and it is usually necessary to neutralize this sludge with soda ash or some other agent. Petrolatum obtained from dewaxing of lubricating stocks has been used successfully for mixing with sludge instead of fuel oil; however, it is not advisable to use a greater quantity than 15 per cent of petrolatum. The acid must be recovered from the sludge before petrolatum can be used with any degree of success; otherwise separation of the fuel will occur.

In many plants both light overhead products and heavy stocks are processed. At our plant we have both types of sludge. The light oil sludge offers little trouble to the treater, as it is a smooth, light-weight asphaltic substance and easy to disintegrate. It may be neutralized with a chemical, fluxed with fuel oil and burned. It may also be cooked with hot water, the acid thereby recovered, and then fluxed with fuel oil. However, advantage may be taken of the comparative ease in handling this light oil sludge by allowing it to serve as a solvent in the preparation of the more complicated heavy oil sludge.

The light and heavy oil sludges are fluxed together, then cooked with hot water by the same process as used for treating the acid from a heavy sludge alone. The solvent action of the light sludge makes a thinner, easier-to-handle product of the mass. At this plant we eliminate the objectionable tendency of asphalt-entrainment in the acid water, sometimes occurring with heavy oil sludge if care has not been exercised in the processing. Where both sludges are present, fluxing them together is a much simpler operation than individual treatment of each.



Recovered-acid separator.

Corrosion and Transfer Problems

When recovering acid from body sludge and mixing the two fuels, no neutralization is necessary. When not removing the acid by washing with water, neutralizing chemicals are necessary. If soda ash is used, difficulty arises from foaming in the kettles, plugging of burner tips and scale on the boiler or still-tubes. The latter is a constant menace, as the unit must be shut down at regular intervals and the scale removed to prevent local overheating. Caustic soda forms such persistent emulsions that its use is almost prohibitive. If there is danger of corrosion when burning the sludge fuel, which takes place in a cold furnace, fuel oil can be used in firing up, and changed to sludge fuel after the unit is warmed. All lines, valves, fittings and manifolds are fabricated of brass or bronze. If lead lines are used, 10 per cent antimony lead is desirable. Unlike metals should not be used together, lest galvanic action occur.

Transfer pumps should be of the screw type with 150 feet head, fabricated of a good quality of acid-resisting bronze. The liquid end should be steam-jacketed and should withstand 15 pounds pressure. The suction lines of the pump should be two feet above the pump suction. After each pumping the line should be blown out into air or washed with 10 or 14 barrels of fuel oil. This will eliminate the possibility of sludge left in the line becoming hard, rendering future operations difficult.

Burning the Fuel

The fuel, after being pumped to the plant fuel tanks, is kept in constant agitation with air and heated with steam coils. Suction is taken off the bottom of the tank, the oil conveyed under 30 pounds pressure through a fuel loop to the burners and discharged back to the tank, entering at the top. This keeps the fuel in constant circulation, preventing the formation of solids in the cone.

An ordinary burner similar to the common fuel oil burner may be used, except that the tip should be ⅛-inch larger. Steam atomization should be employed generously. No ash results when chemicals are not employed for neutralization. When the acidity is 1 per cent or lower there will be no evidence of corrosion.

It has been the experience of the writers that boiler firemen prefer to burn a smooth, hot, homogeneous sludge fuel rather than a straight fuel oil.

There is no doubt that the utilization of acid sludges by their conversion into a satisfactory liquid fuel is a profitable operation. A material that heretofore has been a waste can be made into a product that can be burned easily and economically.

The method outlined, whereby the sludge is fluxed with comparatively small percentages of fuel oil, is outstanding because of its ease of manipulation, its low upkeep cost and its avoidance of the use of expensive chemicals and obnoxious odors. Its original cost is nominal compared with its value. Corrosion problems are negligible if proper materials are used in the construction of the system. No harmful effects result if proper procedure is followed.

A typical test on boilers being fired with sludge fuel processed as explained in the early part of this article follows:

B. T. U. Input	74,500,000
B. T. U. Output	46,600,000
Thermal Eff.	62.8%
B. H. P. Rating	1,250
B. H. P. Developed	2,080
Per cent H. P. Developed	166 %
Per cent CO_2	11.0%

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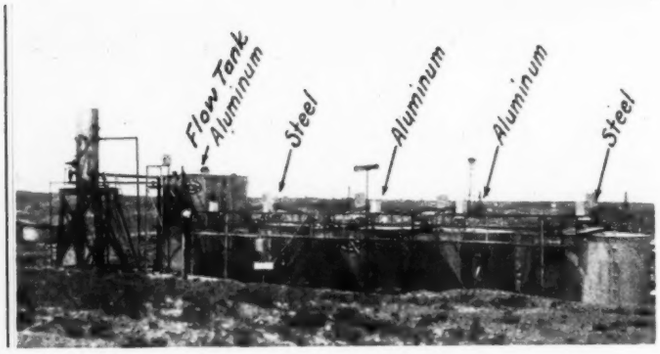

Fig. 1—The test battery, consisting of steel and aluminum tanks, near Borger, Texas.

Aluminum ST
Offer Pr
Possibilities Under Ce

THERE are many factors which influence the corrosive action of sulphur and its compounds when contained in crude oil and a knowledge of the degree of influence of such factors and a consideration of them for the drawing of conclusions are essential when a comparison is to be made of the corrosion-resisting properties of different metals for use in tank construction. Aluminum tanks have been given general tests since 1928 with very interesting results which indicate the possibilities of this metal for field stock tanks. More complete research work involving a study of all operating conditions, however, has since been conducted by the United States Bureau of Mines on both aluminum and steel tanks in such a way that direct comparison could be made and definite conclusions drawn.

A report of Investigation No. 3066 has been made by the Department of Commerce covering the field tests. This presents the results of the work which was done under a co-operative agreement between the United States Bureau of Mines, the State of Oklahoma, the Aluminum Company of America, the Gulf Oil Corporation and the Parkersburg Rig and Reel Company. Many of the details, however, are not included in this report. They not only indicate the thoroughness with which the work was done but also show the careful attention paid to all factors which have any influence whatever on the results obtained under actual field conditions.

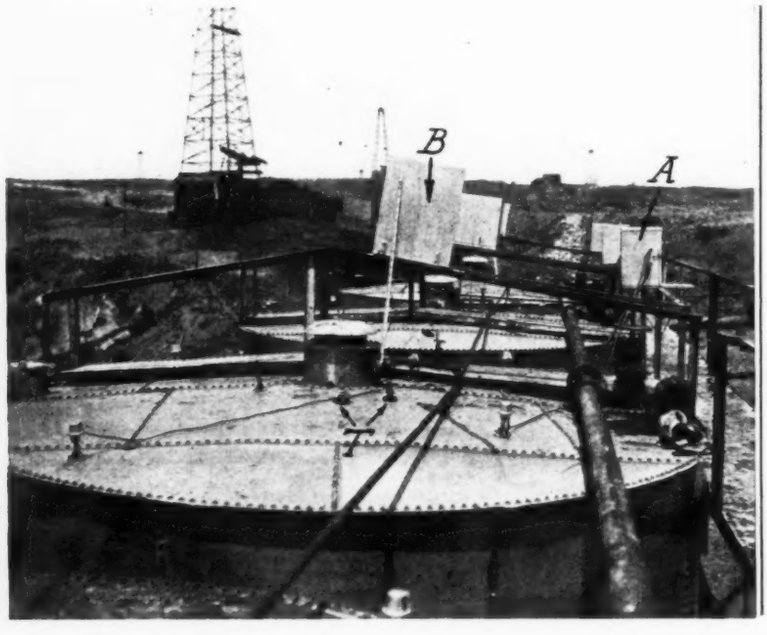

Fig. 2—The tops of the stock tanks, showing the temperature equipment.

The battery of tanks with which the work was done was located near Borger, Texas, and is shown in Figure 1. The separator was of the usual steel construction and was not included in the tests. The flow tank and two of the stock tanks were of aluminum as indicated in the photographs. These were constructed of 0.114 inch deck, side and bottom sheets of manganese aluminum alloy containing from 1 to 1½ per cent manganese. The rafters, ladders, channels and steam coils were of duraluminum and the remaining parts of other aluminum alloys. The two steel stock tanks were of standard construction, one of 0.1093-inch sheets and the other of 0.1406-inch sheets. The entire battery was set on a wooden subgrade covered with heavy tar paper.

The temperature of the fluid (in either liquid or gaseous form) has considerable influence on corroding action. The importance of this was recognized and very elaborate plans were necessarily made to keep a close record of the temperature at various points in all the tanks throughout the entire period of the test.

In order to do this, five thermocouples were installed in each tank roof with five along the side as illustrated in Figures 2 and 3. These were connected to one terminal block for each tank and were housed as shown at "A". The readings were taken every four hours with a potentiometer whether the tank was empty or full and a uniform numbering was provided for all tanks to facilitate keeping the records. Besides these, two recording thermometers were also set in the roof at the points marked "T" in Figure 2 with the instrument housed at "B". These gave on one chart a constant record of the temperature at the top of the tank for both the oil and the vapor since one bulb extended down into the oil when the tank was full and the other was short enough to record only the temperature of the vapor at all times.

The flow tank was equipped with thermocouples and thermometers in exactly the same way as the stock tanks but the water was kept down in it by means of a siphon. An example of the temperatures recorded by the thermocouples in this tank at about the hottest and coldest periods of one day in May is given below. The thermocouple numbers refer to those shown in Figure 4.

Thermocouple No.	Length	Temperature Degrees F. 4 a. m.	Temperature Degrees F. 4 p. m.
1	24 inches	72	96
2	36 "	72	94
3	36 "	72	92
4	12 "	72	92
5	24 "	72	76
Atmosphere		65	90

During this time, the temperature above the oil registered from 71 to 73 degrees F. at 4

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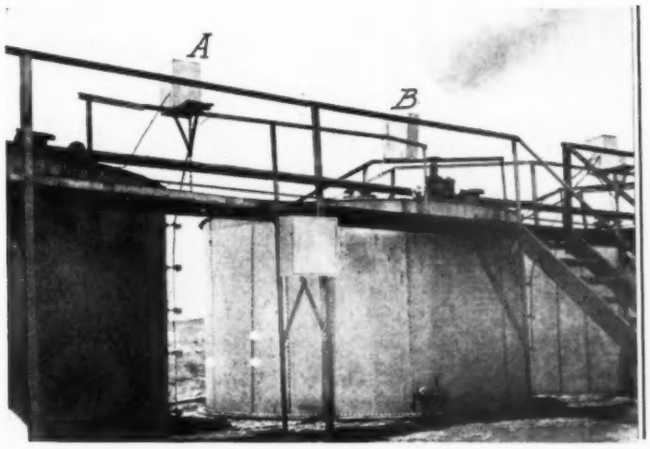

Fig. 3—The complete arrangement and conveniences provided can here be seen.

a. m. and from 98 to 102 degrees F. at 4 p. m. The influence of changes in atmosphere temperature can thus be seen and would indicate that in general lease operations there will be variations in temperature during the day even though steam coils are used in cold weather. The humidity of the atmosphere and of the tank were taken twice a day, that of the latter through the hatch.

Although the recording of temperatures necessitated the greater amount of equipment on the tanks, the other tests being made required a great deal more work and extensive laboratory equipment. Water samples were taken every four hours from the flow tank and were analyzed for carbonate, chloride and hydrogen sulphide. A complete water analysis was made at least once a month and, although this hardly seemed necessary, no chances were taken to let any data that might have an influence slip by.

Gas analyses were made twice a day from samples taken from both full and empty tanks. Oil samples were taken from all full tanks and, besides being ground out in a centrifuge, were tested for hydrogen sulphide content. The oil being run into the battery averaged 33.8 degrees A. P. I. and had a sulphur content of about 0.66 per cent. The hydrogen sulphide content of the water ranged from 18 to 27 parts per million with a general average of 23 parts per million. The production was all from one lease which was operated by the Gulf Production Company in the Borger Field in the Texas Panhandle.

The battery was operated like every other battery and no discrimination was practiced to favor either the aluminum or steel tanks. The water produced with the oil ranged from 1 to 20 per cent and the production was chemically treated at the lead lines by means of a lubricator actuated by the walking beam. The flow from the flow tank into the stock tanks was practically continuous. The tanks were vaportight and the only air entering the system was through the emptying of the stock tank or through the breathing of the tanks.

The oil passing through the battery was of the highly destructive kind produced in the Texas Panhandle district. It included hydrogen sulphide gas, highly concentrated brine and emulsions. Besides the chemical reagent and the heat used to de-emulsify the oil and water, gas agitation was also employed. The daily production averaged from 40 to 50 barrels of oil and 1,000 barrels of water.

The tests by the Bureau of Mines were started in April, 1929, and were continued over a year's period of time. Many interesting and valuable conclusions have been drawn from them and are set down in the above mentioned report. During the entire time, the hydrogen sulphide content of the gas in the vapor space of the aluminum stock tanks was found to be higher than that in the steel stock tanks when both types of tanks were in relatively the same state of operation. It was felt that this condition was probably due to the reactivity of hydrogen sulphide with steel and resulted from a constant removal of this gas by interaction with the material of the steel tanks.

After about six months some changes were made in the all-aluminum flow tank. At this time the tank proper was found to be in good condition with the exception of a few areas on the side sheets that had been constantly subjected to the action of salt water. It had been necessary, however, to make frequent repairs to the aluminum steam coils on account of corrosion which had taken place on the inlet end of the coils. These coils were, therefore, removed and replaced with ordinary steam coils of the same diameter.

The flow tank was then subjected to another four months' service and some interesting conditions observed. It was found that where the side sheets had been exposed to salt water they had suffered a tremendous increase in the amount of corrosion, either directly or indirectly, due to the presence of steel coils. The side sheets had also become completely

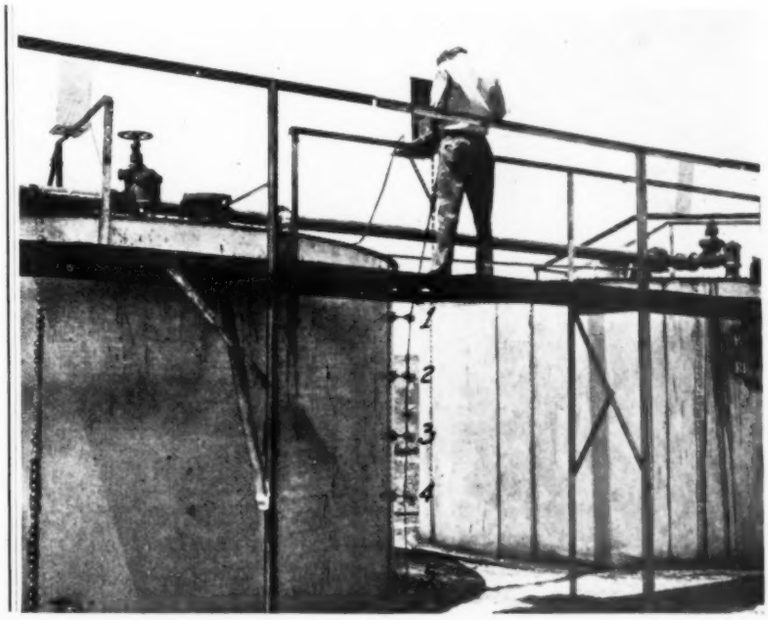

Fig. 4—Using the potentiometer to obtain temperatures at the top and side of the tank. Note the thermocouples with conductors leading to the central terminal block.

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perforated at the points where the coils were flanged into the side of the tank. This trouble, however, was found to occur whether the flanges were made of steel or aluminum.

At this time the aluminum bottom and aluminum side sheets of the bottom ring were replaced with steel. It was the intention to keep the oil-water contact below the center flange of this combination steel-aluminum tank in order to avert galvanic action between the two metals. While making the tests, however, it was found impossible to do this and oil-water contact was often raised above the bottom ring.

After two months of service, a general failure of the side sheets in the top ring was found to have occurred in the form of a complete circle of perforations immediately above the center flange of the tank while the steel side sheets in the bottom ring were almost entirely covered with scale. The tank was then converted into a 250-barrel steel flow tank with only the top sheets, rafters and ladder made of steel.

Complete descriptions of the various types of corrosion encountered on both the steel and aluminum tanks is given in the Bureau of Mines report. Of especial interest is the accelerated corrosion caused by the presence of steel parts as encountered most severely at the points of inlet and outlet of steel steam coils in aluminum sheets. These flanges were insulated by several thicknesses of asbestos gasket material yet the corrosion proceeded rapidly and it was felt that the iron-aluminum circuit was completed through the medium of the surrounding salt water. The same conditions were encountered in the composite steel aluminum flow tank. It was, therefore, stated, "because of the electro-chemical reactions between aluminum and steel inducing corrosion of the type discussed, it is concluded that in tank construction no steel-aluminum contacts should be made in the presence of salt water even if efficient insulation is employed. If steel-aluminum contacts are made in parts of a tank that are to be subjected to the action of oil only, the oil should not carry a high percentage of salt water in suspension."

In concluding the report of the tests on the use of aluminum for oil lease tanks it was stated that aluminum materials have at least three definite limitations, which were given as follows:

"1. The use of aluminum steam coils in flow tanks or stock tanks where the coils come in contact with salt water is not practical; but it is possible that other forms or alloys of aluminum may be developed that will be successful in resisting high temperature salt water corrosion; it was noted that certain of the fittings made of No. 43 alloy resisted such corrosion.

"2. The aluminum tank plate used did not prove highly resistant to the corrosive action of concentrated brines, as was shown by deep etching in those areas of the side sheets which had been subjected to the action of salt water for an extended period. This result was predicted by representatives of the Aluminum Co. at the beginning of the test, and on the whole the metal resisted the action of the brines much better than had been anticipated.

"3. In places where aluminum is used in conjunction with steel, extreme care must be taken that no electropyte such as salt water is present. Even in the absence of salt water such installations should include efficient insulation between the metals.

"Since there was no apparent corrosion of the aluminum in the vapor space of the tanks, observations are now being made on a composite stock tank in which the top 18-inch ring, top sheets, rafters, and ladder are constructed of aluminum, the remainder of the tank being of steel. The results of the service test on this tank will be published at a later date.".

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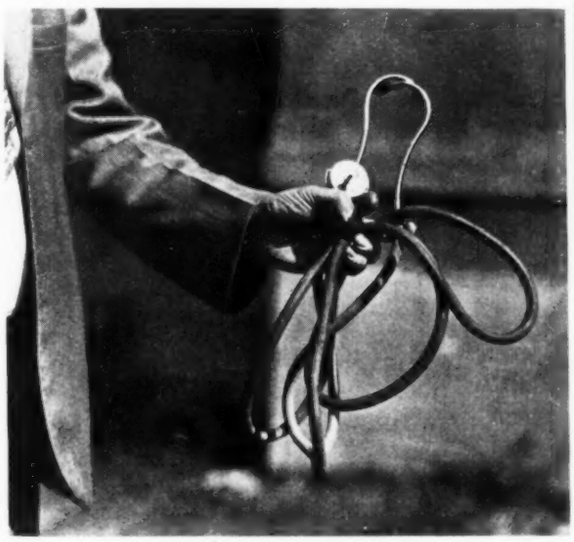
Stethoscope an Aid in Diagnosing Ailments of Pumping Wells

By A. L. FABER[1]

SOME interesting findings have resulted from listening, by means of a stethoscope, to pump and valve operation of oil well pumps. The field for use of such observations seems to the writer to be very broad, and offers great possibilities as an aid in securing better operation of pumping wells. It is with the hope of furthering this method of observation in the different fields, so that through its more extended use valuable data may be obtained regarding ball and seat action, valve cage lengths and valve openings, sucker rod operation, effective length of plunger stroke, effect of counterbalance on pump action, sucker rod vibration, and the causes of such vibration, that this article is being written.

If a string of sucker rods is considered in the same light as the string of a musical instrument, it will be seen that a certain definite vibration is set up, which will vary with the size of sucker rods, size of boxes, type of pump, speed and length of stroke, maximum and minimum stress, rate of change of stress, the straightness of the hole, size of tubing, and depth of well or length of sucker rod string. The amplitude of vibrations will most probably be small, and the resultant sound wave will be very complicated as it will have over-tones, etc., that will have to be segregated.



Stethoscope, with sound tube six feet long, used on pumping wells as described in accompanying article.

The effect of mixing a string of rods is primarily to produce a change in the natural period of vibration of the string of sucker rods and in a great many cases improves rod life. The stethoscope applied to the polish rod will give some indication of the vibration of the sucker rod system, particularly if the sounds are amplified and photographed. We have not as yet gone this far in this work but are preparing to make such a study. We have been able to hear the standing valve close, by means of the stethoscope attached to the polish rod.

The stethoscope held against the tubing gives the closing of the standing valve. The action of the ball can be heard very clearly after some experience and skill in the use of the stethoscope has been acquired. If the ball is not seating properly and when it spins in the cage, the sound will give a definite indication of its action.

The writer has found that the medical type of stethoscope gives the best results. He has used a Fleischer type of blood pressure stethoscope. This instrument has a button that can be screwed into the center of the diaphragm and is very convenient for well use. Photographs accompanying this article show the stethoscope. It will be noted that the sound tube is six feet long, which length is ample for use on wells of 72-inch stroke.

[1]Engineer Arkansas Power & Light Co., Pine Bluff, Ark.

Use of the stethoscope has been made on counterbalancing wells where elastic oscillations of the fluid column are not present. The standing valve closing has been checked against polish rod strokes. On one particular well, it was found that the power curves showed more weight was necessary on the rotary type counterbalance, and 300 pounds more weight was added. Observations by hearing and sight indicated a loss of six inches in length of stroke in the under-counterbalanced well; with the addition of weights this loss was reduced to between one and two inches. The net results obtained at the well checked these observations, as the production was increased ten barrels of oil per day.

Sound travels approximately 16,000 feet per second in steel, so that a slight time correction should be made to determine accurately the closing of valves at the bottom of the hole. Correction for time of sound travel was, in this case, disregarded. The well's characteristics were as shown in table below.

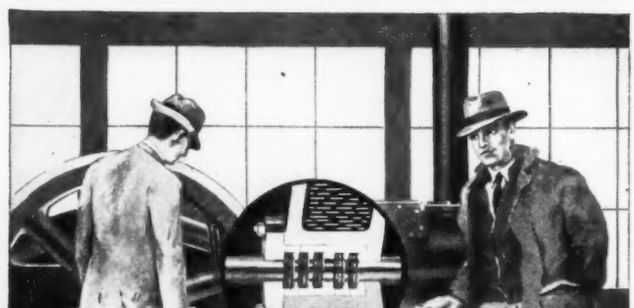
Another practical use of the stethoscope arose through the mistake in issuing from a storeroom the wrong type of balls and seats; as sometimes happens, the California type and the Eastern type got mixed up. Trouble, of course, began to show up quickly. A trip through the field with the stethoscope spotted the small balls at once and the pulling jobs in each case checked our ears.

It has been possible to start a study of valve cages by use of the stethoscope. The turbulences set up due to valve cages in heavy water wells can be heard. While no definite results of tests from a sufficient number of wells have been accumulated, we believe that a great many valve cage arms are too wide and thick for our heavy fluid wells; also that better results are obtained with rounded edges instead of square or sharp edges. Where extra long cages are used the ball can be heard to spin and hit the top of the cage. Later, pulling jobs have checked these observations, as the cages showed the usual ball indentation on the cage guards.

The successful use of a stethoscope requires a great deal of patience and experience. It is not to be expected that all the sounds can be segregated the first few times one listens to a pumping well. In starting out it is suggested that the stethoscope be used on the tubing only, and that a well that is pumping properly be used. It soon will be possible to segregate the fluid roar and possible rod slap from the definite hammerlike sound made by the closing of the standing valve.

Next, if it is possible to listen to a well that is not pumping properly, it will be observed that, if the valve is not seating, two sounds will be heard instead of the definite single closing sound of a valve that is seating properly.

---and here is the PACKING to specify that prevents FIRE!



A LEAKY packing—a static spark—explosion — fire. You probably have some COOK'S Standard Compressor Packing in use and understand the floating feature — positive seal — and long life — making for increased efficiency and reduced maintenance costs. You know there is a total absence of friction producing substances in COOK'S Packing that might cause a spark or overheat the rod and that the compressor may be out of alignment without loss of compression. These advantages are now augmented by the "explosion-proof" feature, a unique means to provide added years of protection against the fire hazard, details of which will be gladly furnished on request. When writing, mention COOK'S Refinery Packing.

"Sealing Pressures Since 1888"

C. Lee Cook Manufacturing Company, Incorporated, Louisville, Ky. Agents and Distributors New York, Chicago, Tulsa, Los Angeles and San Francisco.

COOK'S METALLIC GRAPHITIC IRON PACKINGS

A NEW pamphlet being distributed by The Dillon Company, Tulsa, Oklahoma, describes a test made on Dillon couplings at the Oklahoma Iron Works, Tulsa, Okla. This pamphlet also shows the construction and application of Dillon couplings.

A PRACTICAL HANDBOOK on wire rope has been published by The E. H. Edwards Company, wire rope manufacturers of San Francisco. It contains 192 pages, is pocket size and deals with practical angles of everyday problems in which wire rope users are interested.

In addition to the standard information on construction, size, breaking strength, list price, etc., this handy reference book contains much valuable data on the use of wire rope in the field, this information being conveniently indexed. Handbooks are ready for distribution and may be secured from the Edwards company.

A GENERAL CATALOG on wire products and perforated metals has been issued by Wickwire Spencer Steel Company, 41 East 42nd Street, New York City. In the interest of simplicity and ready reference only essential details and descriptions are included, but additional information may be secured from the company if desired.

THE LANDIS MACHINE COMPANY, Waynesboro, Pa., manufacturers of thread-cutting machinery and thread-cutting die heads, are mailing a new bulletin describing the Lanco Head.

This head is for application to automatic semi-automatic and hand-operated machines. It employs the Landis Tangential chasers on the front face of the head. The head can be used for right- or left-hand threading.

The bulletin shows the Landis standard Lanco Head, as well as the internally tripped head and may be secured from the Landis company.

THE BETHLEHEM STEEL COMPANY with general offices in Bethlehem, Pa., has prepared a pamphlet on its Dardelet self-locking screw thread. This screw thread locks solely by reason of the profile of the thread. It is adapted to bolts, studs, screws, machine and engine threaded parts and many special applications. The pamphlet is generously illustrated.

CRANE COMPANY, Chicago, Ill., has issued bulletin No. 235, describing the complete line of crane oil industry valves. Details of construction, pictures, prices, uses, test pressures, sizes and many other important subjects are presented in this interesting booklet, the title of which is "Steel Drilling-Through or Master Gate and Flow Line or Manifold Valves."

THE BEAUMONT IRON WORKS CO., of Beaumont, Texas, is mailing out pamphlets K-7 and J-19. The former is a descriptive pamphlet of the Dreadnaught tubing blocks, while the latter is descriptive of the company's straight-line Dreadnaught crown block. Both are bronze bushed and Timken bearing equipped.

KEY'S-HOAG LINE SAMPLER, an automatic machine that may be operated in connection with any size pipe line, giving a sample of predetermined size at regular intervals, is described in a new booklet issued by the Key Boiler Equipment Company of East St. Louis, Ill.

THE CALORIZING COMPANY of Pittsburgh, Pa., has published several bulletins on various phases of oil refining.

In one bulletin Calite alloys are thoroughly discussed in regard to exposure to heat. Bulletin No. 3 of the oil refining series discusses the prevention of corrosion in cracking still equipment. It is written by B. J. Sayles. Prevention of Oxidation in Cracking Still Equipment is the title of Bulletin No. 4 of this series. Bulletin No. 5 concerns the selection of material for cracking still construction. The design and use of tube supports in cracking stills is the subject of Bulletin No. 7. Any or all of these bulletins may be secured from the Calorizing Company.

A HANDBOOK has been published by the American Hammered Piston Ring Company, Baltimore, Md. The outstanding types of piston rings and rod packing for internal combustion engines are described in this handbook. Pictures and brief descriptions of some of the different types are given, together with illustrations of typical installations.

Useful engineering data are also included, some of which being published for the first time.

THE MOORLANE COMPANY, Tulsa, Oklahoma, has issued a pamphlet describing the Moorlane Drip, which has been developed as a simple, practical and economical separator designed to extract all entrained moisture from gas, air or vapors. The pamphlet is beautifully presented and may be secured from the Moorlane Company.

VOGT WATER TUBE BOILERS are described and illustrated in a beautiful new booklet issued by Henry Vogt Machine Co., Inc., of Louisville, Kentucky. The information contained in this book is extremely interesting, especially to engineers and those contemplating the installation of new or added steam generating units. On pages 42 and 43 the company's low head type boilers, widely used in natural gasoline operations, are shown. When writing the Henry Vogt Machine Co. for this book, ask for bulletin No. WT-3.

The "OIL & PETROLEUM YEAR BOOK" for 1931 by Walter E. Skinner, just issued, is the 22nd annual issue. Published annually in May and covering all branches of the oil industry, the book is recognized as the standard international reference work on oil and allied companies operating in all parts of the world. The possession of a reliable and up-to-date reference book has become a necessity as it records the many alterations in the personnel and financial structure of British and foreign companies.

Covering 450 pages it contains particulars of 620 English and foreign companies—producers, refiners, dealers, carriers—pipe and steamship—and oil finance companies operating in all parts of the world, including the principal American and foreign companies. Lists are also given of the officials connected with the companies and comprise 2,250 directors, 325 secretaries and 185 consulting engineers, managers, agents, etc., their names and addresses and company connections. A useful feature is the list of 398 trade names of petroleum products marketed by the various companies.

The particulars of each company include the directors and other officials, date established, location of property, purchase consideration, number of wells sunk, oil production, and description of work in progress, capacity of refineries, capital, calls, dividends and financial position as disclosed by latest accounts, also highest and lowest prices of the shares for the last three years and latest price.

The book is published by Walter E. Skinner, 15 Dowgate Hill, Cannon Street, London, E. C. 4. Price 7s.6d. net or post free (Abroad) 8s.6d.

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The Layne Screen will not become clogged with mud or sand and eliminates sand cutting.

Under severe laboratory tests it was found that the Layne Screen can safely withstand the weight of 8,000 feet of casing. Actual field use has demonstrated to thousands of users that there is no other screen to give such a high degree of satisfactory service as the LAYNE.

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Examine a RIDGID *at your Supply Store.*

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PIPE TOOLS

THE LUFKIN LINE May-June, 1931, issue is a very interesting book. It is devoted to the East Texas oil field. Good editorial material and many fine pictures make the book very attractive. It is published by Lufkin Foundry and Machine Co., Lufkin, Texas.

A GAS MEASUREMENT ENGINEERING 220-page general catalog and reference book covering products and operating data for the measurement and testing of manufactured, natural and liquefied petroleum gases has been published by the American Meter Company, New York, N. Y.

A ROTARY MUD SCREEN FOLDER is available from the Link-Belt Company, Chicago, Ill. This new folder, No. 1253, describes the use of the Link-Belt Vibrating Screen for reclaiming, degassing and cleaning rotary mud.

THE NEW UNITED IMPERIAL AIR CLEANER is described in detail in bulletin No. 101, just issued by the United Air Cleaner Corp., Chicago, Ill. The bulletin also gives some very conclusive test results on cleaning efficiencies.

BEAUMONT IRON WORKS CO., Beaumont, Texas, has published two new bulletins of interest to the oil industry. One bulletin describes the dreadnaught walking beam and Sampson post and the other is descriptive of the dreadnaught pull rod blocks. These bulletins are available upon request.

THE NEW MODEL GH Trackson McCormick-Deering crawler tractor is described in the Trackson Company's new circular. This atractive, well-illustrated circular may be secured from the company by writing to it at Milwaukee, Wis.

FOG DISTRIBUTOR CORPORATION, Los Angeles, Calif., has had printed a booklet covering Liquizone, its application in extinguishing oil field fires. Installations of equipment for handling Liquizone in all branches of the oil industry are given.

EMSCO ROTARY SWIVELS are described and illustrated in Bulletin No. 41 issued by the Emsco Derrick & Equipment Company. This booklet punched for insertion into the company's looseleaf catalog file system may be secured by writing to the company at Los Angeles, Calif.

GASO PUMP & BURNER MFG. COMPANY, Tulsa, Okla., is mailing out a circular that describes its J-F Oil Thief. This thief is durably constructed of non-sparking metal and is regularly furnished with chain for taking samples at depths to 70 feet.

LANDMACO THREADING MACHINES of the one-inch and one and one-half inch single and double head type are covered in Bulletin H-75 just issued by the Landis Machine Company of Waynesboro, Pa. This machine has just been placed on the market and the bulletin gives complete specifications of it.

BAILEY METER COMPANY, Cleveland, Ohio, has published Bulletin No. 70 descriptive of Bailey power type pressure devices. The new bulletin describes and illustrates the devices and explains their principles.

Death of E. W. Clark

E. W. CLARK, Chairman of the Board of Directors of the Union Oil Company, president of Union Oil Associates, and one of the national figures in the petroleum industry, died suddenly last month. His death came as a shock to all who knew him, as he appeared to be enjoying the best of health.

Mr. Clark was 73 years old. He was born in New Hampshire July 24, 1857. Throughout his life he possessed exceptional health which enabled him to carry on an uninterrupted business career of more than half a century.

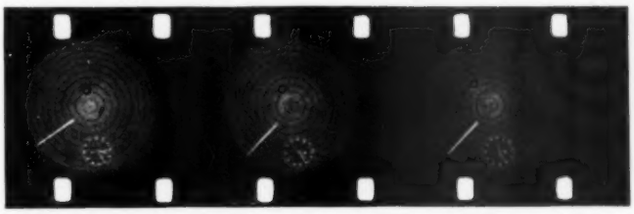
His New England forbears passed on to him a ruggedness of character as well as a ruggedness of constitution. He was a beloved leader and counselor. He was courageous in his beliefs and unhurried in his decisions. Even-tempered and deliberate, both in speech and action, he was calm during the periods of greatest stress.

Though born in New England, he was one of the real pioneers of the West. He was still in his teens when he left his home in New Hampshire in 1876 to come to the Pacific Coast. His funds carried him as far as Nevada, and for twelve years he engaged in mining merchandising and railroad enterprises in that state.

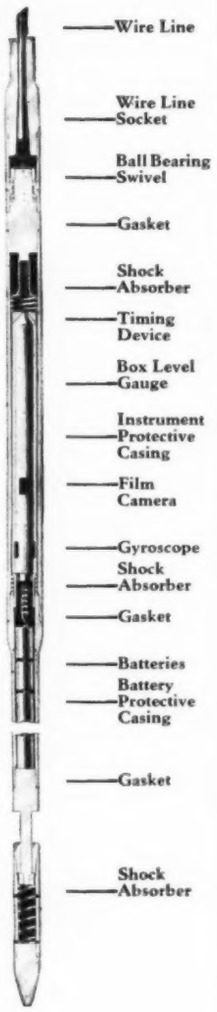
In 1897 he was induced to leave the Northwest to become manager of the Pacific Coast Railway's line operating between San Luis Obispo and Los Olivos. It was while operating this line that he first came in contact with the oil industry in which he was to receive national recognition. He first met the late W. L. Stewart at San Luis Obispo in 1901, and out of that meeting grew a firm and enduring friendship that resulted in Mr. Clark's acceptance of the position of manager of the Producers' Transportation Company in December, 1910. Three years later he was made manager of transportation of the Union Oil Company, and the following year was elected a vice-president and director. In 1916 he was appointed general manager and in 1921 became executive vice-president.

During the World War he was called to Washington, D. C., to serve as a member of the National War Service Committee, and was one of the organizers of the American Petroleum Institute, brought into existence at the close of hostilities. He was accorded national recognition for his service to the industry by his election to the presidency of the Institute for two terms, 1927 and 1928.

In the spring of 1929, following two years as head of the American Petroleum Institute, he for the first time found the burdens of the duties of executive vice-president of the company growing heavy, and in June of that year resigned from the office, remaining, however, a member of the Board of Directors and the Executive Committee.



A "DETECTIVE" of Crooked Holes . . . that tells You Accurately What is Going on Below



The SURWEL Clinograph is saving time, money and trouble in oil fields everywhere.

This remarkable instrument tells photographically and accurately, not only the degree of deviation, but the exact direction of the drift. Wells which have been abandoned in likely territory should be surveyed by the SURWEL. Geologists, too, will find a survey with SURWEL very helpful.

SURWEL is not sold but operated on a service basis by our own experienced crew. Costs and complete data will be given on request.

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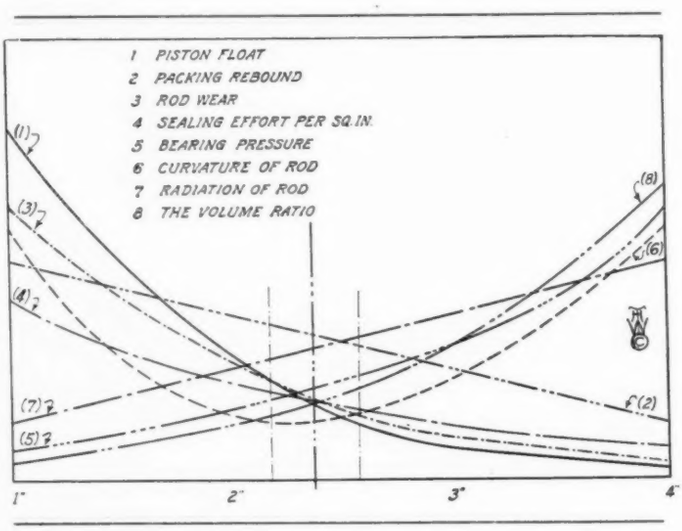
Packing on Gas Compressor Rods

By **HAL T. WHEELER,** *Consulting Engineer, Q-P Packing Corp.*

IN MAINTAINING a satisfactory packing condition on a gas compressor rod, the personal skill of the operator is limited by factors over which he has no control. The success of the packing condition is dependent on the exact analysis, rather than the choice of any particular type of packing.

Packing is a flexible joint which reacts under the impressed pressure to form a contact with the rod, and its chief duty is to prevent leakage. If the work of sealing the rod were all that packing must accomplish, the general packing problem would not exist. And if satisfactory adjustments could be made with any one packing, by means of the devices furnished with the stuffing-box, the question would be settled. The fact is, that many external influences exist and that there are many inherent qualities of shape, size, length, and the like, all of which are doing work against the packing. These influences are sufficient in number so that at all times, a number of aggravating combinations are possible and probable, which in connection with the local and mechanical hazards, may and do result in an infinite number of reactions contrarywise to the normal action of the packing. The common indications of these interferences are excess of temperature, wear of the rod and of the packing, and leakage.



The most important feature of packing is the fact that it reacts against pressure; the effect of stuffing-box adjustments, springs, glands and other parts, is secondary. This group is the equipment with which the packing reacts against the pressure. Opposing the foregoing are many external influences giving reactions due to the inherent qualities of shape, which tend to offset and render useless, the first group. If the two groups combine for a positive, or the reactions are added, high temperature and excessive wear will result; if they neutralize each other, leakage will occur. Adjustment and manipulation by the operator will not change the result of either excess. Packing on a gas compressor rod is subjected to nine chief distributing elements, which can best be understood by plotting them on the diameters, a range being selected from one to four inches. The ordinates of these curves are in percentages.

(1) Piston Float. In small compressors, at pressure release, the piston and rod being light in weight in comparison to the pressures involved, will chatter, the rod striking the packing at a high rate of vibration before the oncoming stroke is started. This effect is common when the liner clearances are excessive. Vibration shortens the life of packing quicker than any other mechanical movement. (On vertical rods vibration is nearly all of the packing problem.)

(2) Rebound of the Packing. A small compressor turns up at a high speed, a large one much slower. The number of times the packing is subjected to the maximum pressure and then released, is a direct ratio of the internal friction of its parts, and the internal work done on overcoming the resilience of the packing structure; the release immediately after compression is called the "rebound," and causes most of this class of wear.

(3) Rapidity of Rod Wear. A small rod wears faster per inch of diameter than a large one, which subjects the smaller packing to an additional internal stress while sealing the poorer contact.

(4) Unit of Sealing Effort. The smaller the rod the more pounds per square inch of contacting surface is needed to seal the joint, hence the smaller the rod the higher the wear from a higher temperature. Smaller diameter packings have a lower factor of safety as the internal stresses are higher for the same pressure.

(5) Bearing Pressure. If the rod and piston are light in weight, the packing may have enough reactive energy to move the rod toward the center-line of motion when misalignment occurs. On larger rods, due to the heavier weights, the packing will be compressed or must move away from the rod, if the latter travels off the center and the bearing pressure must be absorbed or taken care of by the elastic structure of the packing, but without overcoming the reaction necessary to seal the joint. Causes of bearing pressure which are indirectly transferred to the packing by the rod are: (1) pistons riding the shoulders at the end of the stroke; (2) straining of the machine frame during the rise of pressure. Direct causes of bearing pressure are: (1) sag or crookedness of the rod; (2) angular movement of rods not in alignment; (3) prolonged vibration due to excessive clearances of the liner, and (4) shoulders worn on the rod. The work done by the packing structure to absorb bearing pressure is far greater than that expended in sealing the joint.

(6) Curvature. Curvature of the rod necessitates a change in design, according to the radius of the rod and to the impressed pressure. Curvature of the accompanying stuffing-box wall is of still more importance, and there is still further a combined relation of the rod and stuffing-box wall radii which is known as the packing-width factor. The curvature relations of floating rings which do not contact with the stuffing-box wall are expressed in terms of a mean radius. A small rod and a large diameter are equally difficult to seal; the average curvature effect for a variety of packing

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Oklahoma: "Five years ago a city in Oklahoma was piped for gas and the pipe coated with NO-OX-ID. At an inspection in May, 1931, the State Corporation Commission fixed the value of the lines at 93% of new value." *Texas:* "Line treated in 1927 with NO-OX-ID and Wrapper removed from ground shows pipe to be in perfect state of preservation." *Alabama:* "Inspection of pipe coated with NO-OX-ID five years ago shows no signs of corrosion and the line is still in service." *Missouri:* "Inspectors very much impressed with the way NO-OX-ID has functioned. Application of NO-OX-ID and Wrapper five years old and good for a number of years to come." *Louisiana:* "Examination of 8 and 12 inch line reconditioned and coated with NO-OX-ID in 1922 shows no evidence whatever of new pitting and all old pits inactive." *California:* "Line coated three years ago with NO-OX-ID and Wrapper and laid parallel to pavement. County Board recently decided to widen pavement and after inspecting condition of line laid *a nine-inch pavement over it.*"

In such typical reports as these has Time's endorsement of NO-OX-ID been written. All of the thousands of miles of NO-OX-ID protected pipe line are competently and reliably protected as the lines reported above.

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Building for the Gas Industry

Above Booster Pump Station, located at St. Louis, Missouri, on a 22-inch gasoline line from Monroe, La., to St. Louis, was erected complete in 90 days by "Pittsburgh-Des Moines" for the Mississippi River Fuel Corp.

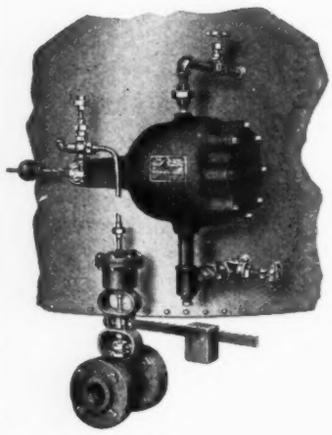
Three similar booster stations of five buildings each were also erected by PDM at Perryville, La., Glendale, Ark., and West Point, Ark.

A compressor building (66'6"x196'), an auxiliary building and a warehouse (each 40'x68'), a regulator building (12'x20'), and a pump house (16'x36') comprise each station. A PDM Elevated Water Tank can be seen at the right.

Pittsburgh - Des Moines Steel Company

3490 Neville Island, Pittsburgh, Pa. 1295 Praetorian Bldg., Dallas 991 Tuttle Street, Des Moines, Ia.
New York Chicago San Francisco Atlanta Seattle

For Remote Control
of Liquid Levels in Refining



The rate of flow from Stills, Vaporizers, Bubble Towers and Dephlegmators must be controlled in order to maintain the necessary level of the contained condensates. The sure, safe and satisfactory system of exercising remote control is represented by the horizontal-float type VIGILANT Liquid Level Regulator. Details upon request.

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Level Controller
—maintains the diaphragm valve in a throttling position while the liquid is within the range of the desired levels. This type handles liquids up to 300 lbs. and 750° F.
The 5½" float movement is reduced by the leverage so that the power of the float is multiplied 250 times, eliminating chance for binding and making possible a stuffing box adjustment which will not leak. Send for Catalog 900-51.
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Instruments for Indicating, Recording and Controlling
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types is at about a minimum on a 2¼-inch diameter.

(7) Radiation. For the same ratio of compression, a large rod has less radiating surface per cubic inch of volume, hence the temperature will increase with diameter. Lubrication problems increase with higher temperatures in company with higher friction.

(8) The Volume Ratio. The larger the rod the greater the space occupied by the packing, as both the entire length of the set and the width of each section must increase with the larger diameters. Every type of packing correctly designed to satisfy the foregoing requirements, for every pressure range has a proper length of actual contacting surface which will give a minimum total friction and a maximum durability. With larger volume, however, a poorer radiating ability of the packing exists, and a longer time is necessary for the cleansing of sand, water, and other foreign matter.

(9) Foreign Matter (not plotted). Sand and mill scale are abrasive to all moving surfaces. Water washes lubricant from the rod surface and causes friction by contact. Mineral seal oil and gasoline tailings from gasoline plants cut the lubricant and increase friction. Paraffin gums the moving parts and reduces the elastic reaction. The effects of foreign matter are least with any type of packing, when it is proportioned to operate on the minimum possible effort per square inch of contact of rod surface.

It should be obvious that as packing is built to seal pressure, that that same pressure will be the leading factor of design and of the operation. Pressure on a gas compressor packing is also the greatest variable of all of the forces and it is necessary to know how it reacts at all stages between the highest and lowest limits. Every packing type will seal pressure successfully for limited ranges of pressure, on certain ranges of rod diameters favorable to its construction and ability to react. But no type of packing will seal extensive ranges of pressures on all diameters unless the construction is altered with respect to the diameter, thereby controlling the net reaction to the impressed pressure; all attending requirements of construction for shape and the effects of interfering mechanical movements must be compensated for on the diameter selected.

Packing must accommodate itself to all of the variable forces, to the requirements of construction limited by inherent shape, and then must have a measure of operating safety to absorb the additional chemical and mechanical hazards introduced as the local condition, or it will not seal the rod correctly.

The operating and mechanical information represented by the curves has been secured by tabulating averages over a long period of time, and the factors of design have been developed from theoretical stuffing-box relations. The features which are magnified on a small rod are found to be unimportant on a large one, and vice versa. The range of rod sizes between 2¼ and 2½ inches are exempt from severe disturbances and it would be expected that the majority of packing types will show the best performance in this range.

From an operating standpoint, even though there is no information on hand to check the complications of design, these curves are useful for locating the possible cause of trouble by keeping in mind those features which are at a maximum in the range of rods considered.

Col. Thompson Makes Dedication Speech

COL. CARMI A. THOMPSON, chairman of the board of the International-Stacey Corporation, delivered the introductory speech at the dedication of the new Ohio state office building. Colonel Thompson was appointed by Governor Cooper as chairman of the Ohio State Office Building Commission and has been largely responsible for the rapid progress made in its construction.

Ampco Non-Sparking Tools Used on Sinclair Wild Well

AFTER the fire at Sinclair Oil & Gas Company's No. 1 Cole near Gladewater, East Texas, had been shot out with a huge blast of gelatin the company took every precaution possible to prevent the well re-igniting.

The company placed an order for non-sparking tools and wrenches with C. Allen Fulmer, Tulsa, District Manager of Ampco Metals, Inc., before the fire was out and these tools were at the well site ready to be used in capping the well when the fire was conquered.

The Ampco factory at Milwaukee were advised by telephone to ship down the assortment needed, such as hammers, wrenches, stillsons, sledges, etc. These were sent by plane from the Chicago airport to Dallas, thence by truck to Gladewater. The shipment was of such weight and bulk that it required the chartering of a passenger transport plane for the service. This plane was the only one to leave the Chicago airport that day, due to poor flying conditions, and the pilot flew all night to get the tools in Dallas the next morning.

The tools were made of a special bronze alloy, hard enough to cut steel, and yet were non-sparking. Some of the tools ordered were huge chain tongs which had to be made to order and the Milwaukee plant worked day and night to get the tools out.

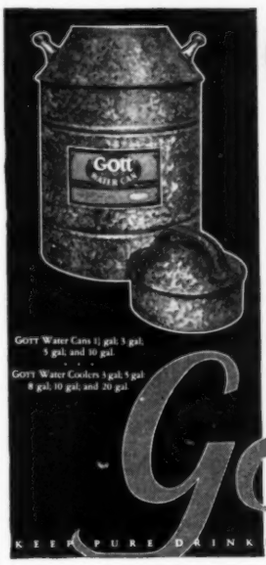
The Milwaukee plant worked day and night to get these tools out so they could be used in closing the well in.

Sucker Rods Topic at Drumright Monthly Meeting

THE use, care and manufacture of sucker rods was the subject at the May monthly meeting of the Drumright chapter of the American Petroleum Institute.

Motion pictures played a big part in the discussion. D. H. Collins, production engineer of the Gypsy Oil Company, presented a picture of the right and wrong method of handling sucker rods in connection with his talk on the subject. The picture was made of Gypsy operations in the Seminole field.

A motion picture showing the manufacture of Jones rods was shown and explained.



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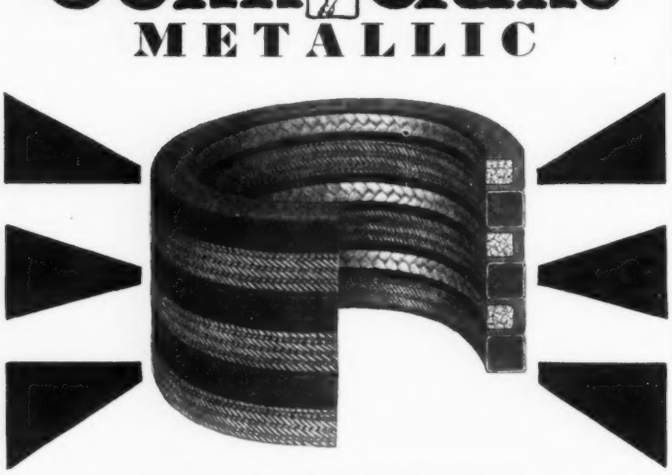

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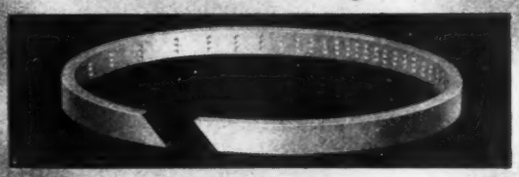

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Merco Nordstrom Moves Los Angeles Office

THE Merco Nordstrom Valve Company announces removal of its Los Angeles office, formerly at 556 South San Pedro Street, to new and larger quarters at 1709 West Eighth Street. The move, according to H. Boezinger, manager for Southern California, was necessitated by a need for a more central location and additional space to handle the company's rapidly increasing business in this section. Enlarged warehouse facilities will also be maintained.

Refinery for Peru

ACCORDING to the Petroleum Times (London), the Peruvian Oil Corp. will construct a 10,000-barrel refinery at Borza, on the Maranon River, near the source of the Amazon River. The company is a subsidiary of the Pacific-Amazon Railroad Corp., which plans to build a railroad connecting with a large concession from the Peruvian Government.

Neilan Opens Pittsburgh Office

NEILAN CO., LTD., manufacturers of automatic regulating and control equipment, announce the opening of a branch office located at 1301 Clark Building, Pittsburgh. Bruce Irwin, sales engineer, has been appointed as manager in charge of this new office.

Mr. Irwin is experienced in plant design and this background will enable him to be of real assistance to engineers in the selection of proper control devices.

Dewaxed Lubricating Oil Patented

THE United States Patent Office recently issued to the Texas Pacific Coal and Oil Company of Fort Worth, Texas, a basic patent on dewaxed paraffine base lubricating oil.

The invention is the work of Dr. Erwin R. Lederer, Vice-President of the Texas Pacific Coal and Oil Company, and is another triumph of scientific research.

For years past, automobile engineers had to contend with congealing and solidification of the best obtainable lubricating oils at low temperatures. They met this problem by diluting or blending the heavy lubricating oils with lighter distillates for winter or low temperature driving conditions, or resorted to asphalt base oils of low cold test, considered not equal to the quality desired for use in modern engines.

There was, evidently, a serious demand for an all-season, all-weather paraffine base lubricating oil.

The Texas Pacific Coal and Oil Company, under the direction of Dr. Lederer, undertook to solve the problem of completely dewaxing paraffine base lubricating oils in order to produce oils which would not freeze at low temperatures, and after several years of research and expensive plant development offered to the trade its completely dewaxed paraffine base lubricating oil in September, 1927.

This oil is an unblended, heavy-bodied paraffine base lubricant, having a cold test of 0° F. and lower and is pumpable at normal pump pressures at temperatures as low as 40° below zero.

Since its introduction in 1927 this oil has been in widespread use for automobile and particularly for aviation use, where the heavy-bodied lubricant supplies a lubricating

film on the bearings at temperatures from minus 40° F. to 600° F. and makes it possible to fly over mountains or at high altitudes in arctic or tropical climates without fear of the oil pipes becoming clogged by wax or the bearings becoming dry from lack of proper lubrication.

After this oil was offered to the public various of the large oil companies adopted the process of the Texas Pacific Coal and Oil Company and installed equipment to produce this oil.

Hanff-Metzger Appoints Industrial Advertising Head

THE Los Angeles office of Hanff-Metzger Advertising Agency has just announced the appointment of Robert R. Berry to head a special industrial advertising department. The agency maintains offices in the Paramount Building, Los Angeles, and in New York City.

"Bob" Berry needs little introduction to oil tool manufacturers and supply men, as he has been engaged in petroleum industry and allied advertising for the last ten years in Los Angeles.

Grout Engineering Company Is Organized

THE Grout Engineering Company, Ltd., was recently organized at Montreal, Canada, with D. L. Alexander of the Alexander Diamond Drilling Company, Montreal, Canada, as President; F. D. Sullivan of The Sullivan Company, Memphis, Tenn., as Vice-President; and T. E. Ward, President of Oilfield Equipment Company and The Sullivan Company of New York.

The organization of this company was brought about through the successful results obtained by the use of Fissurseal, a product invented and developed by F. D. Sullivan.

An American company has also been organized, known as Grout Engineering Company, Inc., a Delaware corporation, with offices at Memphis, New York, Dallas, New Orleans Los Angeles, Tulsa, El Paso, Seattle, Minneapolis and Chicago.

Colorado Fuel and Iron Granted Dardelet License

THE Dardelet Threadlock Corporation has granted licenses to the Colorado Fuel and Iron Company for the manufacture and sale of track and commercial bolts and nuts formed with the Dardelet Self-Locking Thread.

"Economic Significance of Specifications for Materials"

EXECUTIVES and business men will be interested to know that at a joint session of the American Society for Testing Materials and the Western Society of Engineers, to be held during the Annual Meeting of the A. S. T. M. at The Stevens, Chicago, the "Economic Significance of Specifications for Materials" will be discussed. The joint session will be held Thursday evening, June 25, and will be attended by leading technical men.

The A. S. T. M. in this joint session will give to business men the impressions of five leading executives as to how specifications really do affect daily business. John Brunner,

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FOR use in the Pictorial Petroleum Section, The Petroleum Engineer desires unusual and interesting photographs. These may be of field scenes, new installations, new hook-ups, individuals, or any subjects likely to appeal to men in the petroleum industry. Especially do we want pictures of "old-timers" who are still active in the business and views with a foreign setting.

If you have such photographs, we shall appreciate your permitting us to reproduce them in our pictorial section. Extreme care will be exercised in handling them and they will be returned in the same condition as received. Kindly address photographs to—

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ON PAGE 94 of this issue is the "Strange but True" feature, in which exceptional interest is shown by readers of The Petroleum Engineer everywhere. In your experience in the oil and gas business you have witnessed or heard recounted many happenings of equal interest and weirdness as those illustrated on that page. Why not pass them along by permitting us to use them in our feature? Write and tell us your "strange but true" experiences. We'll have them illustrated and give you credit at the time of their appearance. Address The Petroleum Engineer, Box 1970, Tulsa, Okla.

Illinois Steel Co.; P. Park, Pullman Co.; J. P. H. Perry, Turner Construction Co.; A. R. Lord, Consulting Engineer, and J. W. Bancker, Western Electric Co., will discuss the subject from the various angles of producers, consumers, and purchasing agents. These addresses will introduce the subject and the meeting will be then opened for general discussion from the floor.

The committee planning this joint session is composed of Zay Jeffries, Consulting Metallurgist, Aluminum Company of America; E. S. Nethercut, Director, Western Society of Engineers; G. E. Warren, Assistant General Manager, Portland Cement Association, and C. L. Warwick, Secretary-Treasurer, American Society for Testing Material.

Meriam Company Appoints Chicago Sales Representative

THE Meriam Company, 1955 West 112th St., Cleveland, Ohio, manufacturers of flow meters, draft gauges, filter flow meters, "U" and well type manometers and pulsation shock absorbers for pressure gauges, announce the appointment of Mayer & Oswald, 332 South LaSalle St., Chicago, Ill., as its sales representative in the Chicago territory.

C. E. Naylor Moves Office

C. E. Naylor, Manufacturers' Agent, specializing in railway and refinery supplies, Esperson Building, Houston, Texas, announces the removal of his office, effective June 1, 1931, to offices with the Maintenance Engineering Corporation, 1400 Conti Street, Houston, Texas.

Arthur G. McKee & Co. Get Foreign Contract

Arthur G. McKee & Co., engineers and contractors, have received a contract from Distillazione Italiana Combustibiles, S. A. Venice, Italy, for process petroleum refining equipment. The equipment will be designed to increase the efficiency and capacity of existing petroleum refinery process units. This is the second contract placed by the company with McKee in the past three months.

Resistcor Engineering Sells Coating Division

THE coating division of Resistcor Engineering Corporation has been purchased by three of the organizers of Resistcor: R. D. Hardcastle, J. B. Heymes and Edgar R. Pitcher. They are incorporating under the name of Resistcor Products, Incorporated. Offices and warehouses will be maintained at Tulsa, Houston and Memphis.

Brauer Machine & Supply in East Texas

THE Brauer Machine & Supply Company of Oklahoma City have opened a machine shop at Arp, Texas, that is modern in every respect and is equipped for all kinds of drilling, production and pipe line work.

The company has also opened a new supply store at Arp and is stocking a complete line of drilling and production specialties. It will open another store at Willow Springs within a short time.

Kansas Now Most Active Cable Tool Area

McPHERSON COUNTY, central Kansas, is the scene of the most extensive cable tool drilling development in the Mid-Continent, having nearly 70 operations. McPherson, the state's first ranking county as an oil area last year, holds even greater promise for 1931. Present activity is in the Decker-Ritz area, 10 miles east of McPherson, the county seat. Activity is spread over an area approximately eight miles in length, running slightly southeast by northwest, and two miles in width.

The Decker pool, immediately adjoining the Ritz field on the north, is primarily a gas-producing district of three or four miles length. Production varies from small wells of a few million cubic feet to wells having a production of 47,000,000 cubic feet, and rock pressures approximating 900 pounds. The producing horizon encountered at 2900 feet is the chat formation found in many localities in central Kansas. Tests are located in the center of each 40 acres.

The casing practice in the field is to drive 20-inch pipe through the quicksand found from 100 to 150 feet below the surface of the ground. Several water-producing sands are encountered as the bit penetrates deeper, and these, with caving formations, necessitate the setting of several casing strings.

Cable tool drilling well in McPherson County, Kansas.

The second string of casing is the 15-inch set at about 650 feet, followed by the 12½-inch pipe set at 1400 to 1500 feet. The 10-inch casing is run at 2150 feet and carried to about 2300 feet. The 8-inch casing is set on top of the chat at 2900 feet. If the well is to be drilled to the Viola lime this casing is carried through the chat. The Viola lime wells have the 6-inch pipe set at 3400 feet, or on top of that producing formation.

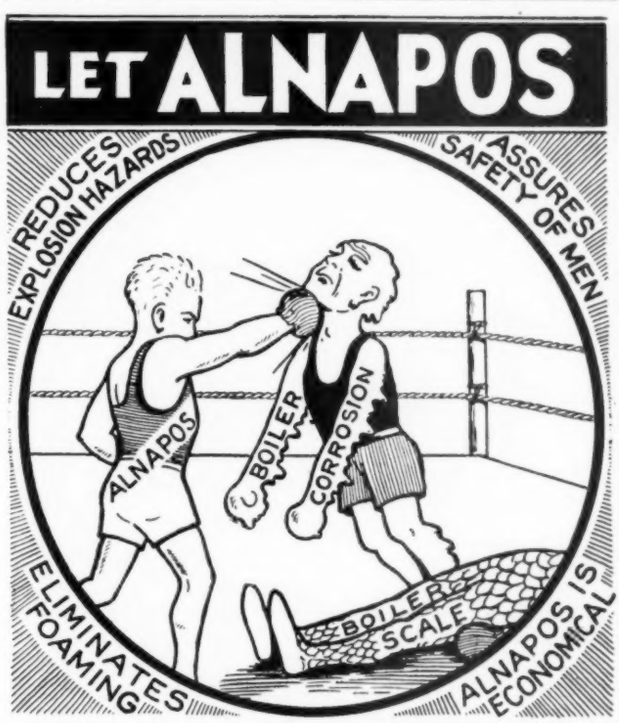
While the drilling time depends upon conditions encountered, the average is probably from 50 to 55 days with cable tools.

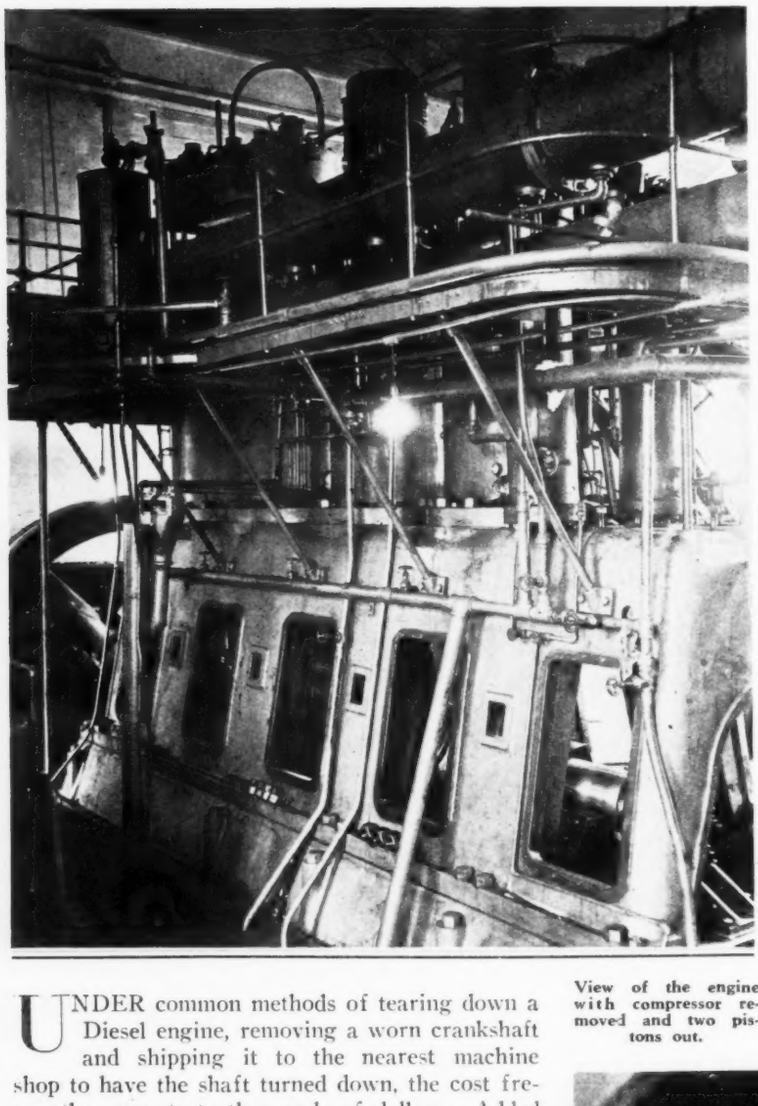
There is little drilling contracting on the footage or turnkey job basis, as most of the tools belong to those interested in the acreage. The Shell Petroleum Corporation, largest leaseholder, has "farmed" much of its acreage out to drilling contractors and is being carried for an overriding royalty.

The topography of the area is slightly rolling, the elevation of the area being a little more than 1,500 feet above sea level.

A few supply stores are located in the field, but most of them are in McPherson, a town of 5,000 people. In Wichita are supply stores of almost all the major dealers as well as offices and warehouses of many equipment manufacturers.

There's a Nu-Alloy Ball and Seat for any field condition and any size or type valve.
Warehouse Stocks: Houston, San Antonio and Wichita Falls, Texas; Tulsa, Oklahoma; El Dorado, Arkansas; Coffeyville, Kansas.
Within two hours after your order is taken, your Nu-Alloy Balls and Seats will be on the way. Have you our catalog? Write for it.
PETROLEUM EQUIPMENT COMPANY of TEXAS
INCORPORATED
Jon R. Long, Mgr. Plant and Office: Fort Worth, Texa.





View of the engine with compressor removed and two pistons out.

Large Diesel Crankshaft Turned Down in Crank C

By J. C. McCONNELL, Asst. Di

UNDER common methods of tearing down a Diesel engine, removing a worn crankshaft and shipping it to the nearest machine shop to have the shaft turned down, the cost frequently amounts to thousands of dollars. Added to this is the long down time of the engine. Moreover, on a large engine in a pipe line station it is sometimes extremely difficult to make such a repair job.

To overcome the major objections connected with such a laborious task and with the view of materially reducing the costs, Leo McLaughlin, assistant master mechanic, Prairie Pipe Line Co., devised a method of truing up the shaft without removing it from the engine. This departure from common methods consists of constructing a small lathe in the engine crank case and turning the shaft in its own main bearings by means of auxiliary power. It not only saved many hours of down time for the unit along with a difficult dismantling job, but accomplished the job at approximately 25 per cent of the cost under former methods.

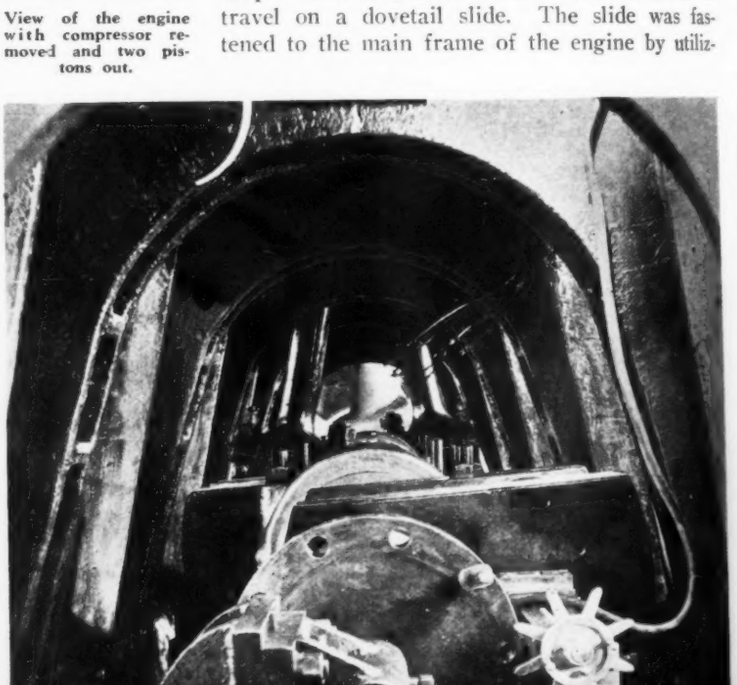
Its true value was clearly demonstrated when a general overhaul job on a four-cylinder, four-cycle, 665-horsepower vertical engine in a station, revealed, after measurements, that the crankshaft was worn flat in the first main bearing at the air compressor end of the engine.

This unit had been in service eight years and during the past two years it was suspected the shaft was out of true because of the rapid wear of the bearings. No attempt was made to correct this condition because the services of the engine were needed and it was considered more economical to replace bearing shells than to shut down the engine for a long period.

The engine is located in a comparatively small room with another unit of similar size and horsepower. Because of the cramped quarters it would have been necessary to tear out part of the station wall in order to move the shaft outside. The engine, too, would have to be completely dismantled, entailing a heavy expense and consuming considerable time.

All of this difficulty was overcome by means of the shaft turning tool. It saved having to completely dismantle the engine, tearing out any of the station walls and accomplished the task in far less time than ordinarily required and at less expense.

The tool consists essentially of two pieces of equipment, the compound rest or tool holder and the tail stock. All of the drawings for it were made at the company's Caney (Kan.) machine shops. The tool holder was assembled so as to travel on a dovetail slide. The slide was fastened to the main frame of the engine by utiliz-



Detailed view of tail stock, looking down the shaft.

Crankshaft in Engine Case

Asst. Div. Engineer, Prairie Pipe Line Co.

ing the main bearing bolt holes. It may be adjusted for alignment by means of set-screws at each end, one of which is shown in the photograph. The tool holder was driven across the slide by means of an Acme threaded feed screw with 10 threads per inch.

A star wheel and hand wheel were attached to the front end of the feed screw to move the tool along the shaft. A pin inserted in a bolt hole on the flange at the end of the crank shaft rotated the star wheel with each revolution of the shaft. This, of course, advanced the tool along the shaft as the cut was made. The hand wheel was used for setting the tool. An ordinary tool made with good cutting steel was used.

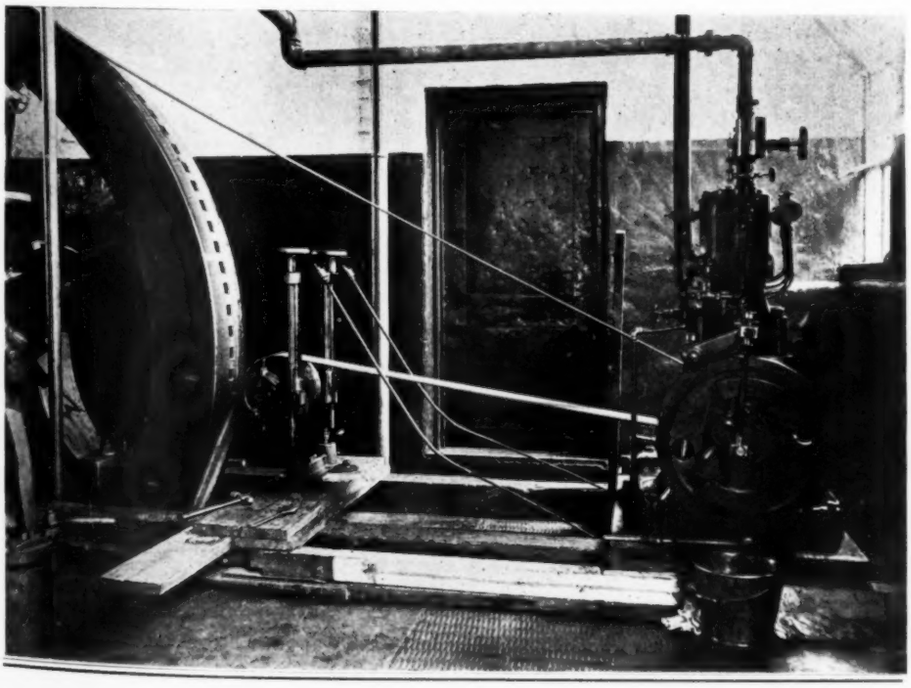
The tool stock was so designed that the center pin could be adjusted to any desired position. The base and bracket of the tail stock were made up with 1½-inch steel plates with the joints arc-welded. The bolts holding the tail stock to the bracket and those holding the bracket to the base run through slotted holes. This permitted the tail stock to be moved vertically or horizontally, by means of set screws, in centering the center pin.

It was necessary to drill holes in the bottom of the crank case to bolt the base to the floor of the crank case. Because of the irregularities in the bottom of the case, babbitt was poured between the case and the base to give the base a firm and smooth footing.

Cutting tool making repairs to engine shaft.

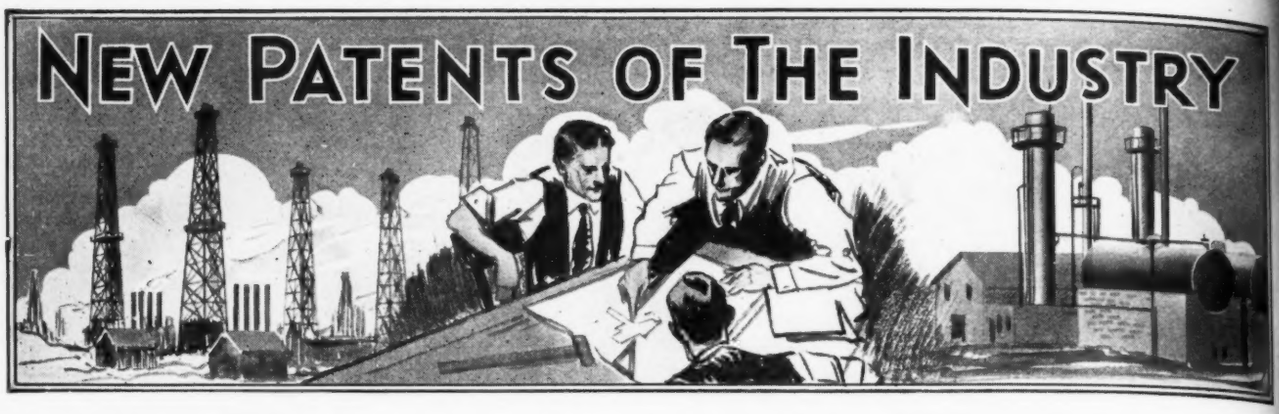
In preparation for the work on the shaft the air compressor cylinder and connecting rod were removed. Two of the pistons and connecting rods were removed to cut down the load that would have to be turned. The last two pistons and connecting rods were left in place to insure smooth running of the shaft Valves on these two cylinders were removed to eliminate compression. All main bearings except the one located where the shaft was to be turned down were adjusted and tightened.

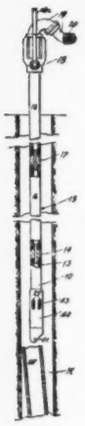
On account of a considerable portion of the shaft being unsupported there was a tendency for it to weave. To avoid undue strain on the tail stock caused by this weaving and to obtain accurate cut, jacks were placed between the first two crank webs for the purpose of aligning the shaft and holding it true.



View showing steam engine connected to fly wheel.

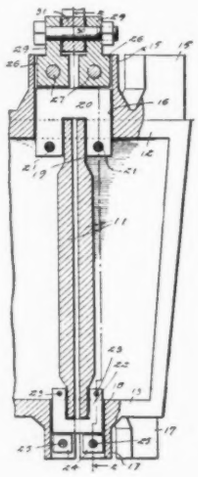
NEW PATENTS OF THE INDUSTRY





1,794,652. HYDRAULIC TRIP SPEAR. FREDERIC—STONE, Los Angeles, Calif., assignor to Doheny-Stone Drill Co., Los Angeles, Calif., a Corporation of Delaware. Filed May 25, 1929. Serial No. 365,909. 32 Claims. (Cl. 294—96.)

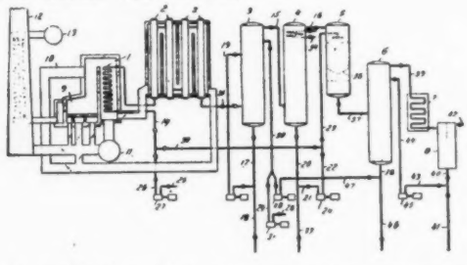
1. In a trip spear, an elongated body member adapted to be lowered into the bore of vertically extending, tubular work, a sleeve mounted about the body member for vertical reciprocation, thereover, said sleeve having an opening through its wall, a work gripping jaw directly carried by the body member and movable radially with respect thereto and through said opening into and out of work gripping position, and means for reciprocating said sleeve, said jaw being movable to and from work gripping position by virtue of said sleeve movement.



1,796,500. PIPE-GRIPPING MEANS FOR ROTARY WELL-DRILLING RIGS. LEE J. BLACK, Beaumont, Tex. Filed Feb. 15, 1930. Serial No. 428,733. 14 Claims. (Cl. 24—263.)

1. A slip including two conjoined slip sections having lateral walls, and means holding said slip sections together comprising separate U-shaped clips extending over the adjoining walls of the sections at the top and bottom thereof and means for locking said clips in place.

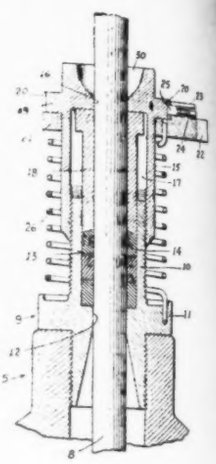
1,795,067. ART OF REFINING HYDROCARBONS. FRANK A. APGAR, Hammond, Ind., assignor to Sinclair Refining Company, New York, N. Y., a Corporation of Maine. Filed Sept. 14, 1928. Serial No. 305,880. 3 Claims. (Cl. 196—96.)



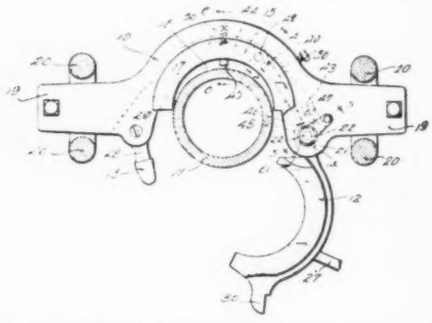
1. In the combined cracking of oil to produce gasoline and refining of the cracked gasoline by passage through an adsorptive catalyst in vapor phase, the improvement which comprises subjecting the raw vapor mixture from the cracking operation proper to a scrubbing operation for separation of unvaporized oil, tar and tarry matter, separating an oil condensate higher boiling than gasoline from the raw vapor mixture discharged from the scrubbing operation before the vapor mixture including the gasoline vapors to be refined is passed through the adsorptive catalyst, passing oil condensate so separated from the raw vapor mixture through the adsorptive catalyst with the vapor mixture including the gasoline vapors to be refined during the refining operation as a liquid washing agent, separating the washing agent and associated polymers from the refined vapor mixture and introducing the separated washing agent and polymers directly into the scrubbing operation.

1,804,581. STUFFING BOX. WILSON B. WIGLE, Compton, Calif. Filed March 26, 1929. Serial No. 349,997. 2 Claims. (Cl. 286—34.)

1. A stuffing box construction comprising a lower bored member for the reception of packing elements, said member having a concentric counterbore for the passage of a pump rod, a gland member engaging said packing elements, an upper bored member engaging the lower member, a coiled spring interposed between said upper and lower box members, means to wind said spring to increase its tension, and means to maintain the tension in the spring after a winding operation, whereby as the packing elements wear the spring will rotate the upper box member downwardly to compress the packing elements.

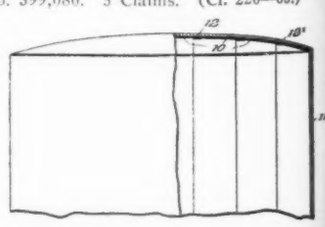


1,804,758. ELEVATOR. JOSEPH G. FITZPATRICK and ROBERT W. FLINT, Anaheim, Calif., assignors to Joseph F. Flint, Long Beach, Calif. Filed December 23, 1929. Serial No. 416,112. 13 Claims. (Cl. 294—90.)



1. An elevator of the character described including a body adapted to be arranged around an object, a gate pivotally attached to the body and adapted to retain an object in the body, a pivot pin connecting the body and gate, and means acting torsionally directly on the pivot pin for shifting the gate to the closed position.

1,790,643. METALLIC PROTECTIVE COATING. STANTON U. McGARY, WALTER F. ROGERS, and STANLEY GILL, Houston, Tex., assignors to Gulf Production Company, Houston, Tex., a Corporation of Texas. Filed Oct. 11, 1929. Serial No. 399,080. 5 Claims. (Cl. 220—63.)



1. A protective covering for an object designed to prevent injury of said object by corrosion comprising a coating of plastic adhesive material covering the surface of the object and a sheet of resistant metal having a thickness greater than .0005" and less than .010" pressed into intimate contact with said coating and held thereto by the adhesive property thereof, said resistant sheet having such inherent flexibility and said adhesive coating having such inherent plasticity as to be capable of relative movement under differential thermal expansion and contraction without separation from each other or from said protected object.